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TRANSACTIONS

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

FOURTH SESSION,

HELD AT PHILADELPHIA, PA.,

SEPTEMBER 16, 17, AND 18, 1890.

VOLUME III.

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PHILADELPHIA:
PUBLISHED BY THE ASSOCIATION.
1890.

NOTE.—The Association assumes no responsibility for the statements or opinions published in this volume.

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LIST OF OFFICERS.

[Elected September 18, 1890.]

PRESIDENT.

A. B. JUDSON, M.D.

VICE-PRESIDENTS.

AP MORGAN VANCE, M.D.
GEORGE W. RYAN, M.D.

CORRESPONDING SECRETARY.

SAMUEL KETCH, M.D.

SECRETARY AND TREASURER.

JOHN RIDLON, M.D.,
337 W. 57th Street, New York.

COMMITTEE ON MEMBERSHIP.

E. H. BRADFORD, M.D. (*Chairman*), BENJAMIN LEE, M.D.,
ARTHUR J. GILLETTE, M.D., SAMUEL KETCH, M.D.,
L. A. WEIGEL, M.D.

EXECUTIVE COMMITTEE.

The President and the Secretary.

PUBLICATION COMMITTEE.

JOHN RIDLON, M.D. (*Chairman*).
A. B. JUDSON, M.D.
SAMUEL KETCH, M.D.

MEMBER OF EXECUTIVE COMMITTEE, CONGRESS OF AMERICAN PHYSICIANS AND SURGEONS.

NEWTON M. SHAFFER, M.D.
Alternate: V. P. GIBNEY, M.D.

LIST OF PRESIDENTS.

1887. V. P. GIBNEY, M.D.
1888. NEWTON M. SHAFFER, M.D.
1889. E. H. BRADFORD, M.D.
1890. DE FOREST WILLARD, M.D.
1891. A. B. JUDSON, M.D.

MEMBERS.

1889. Bartow, Bernard, M.D. Clinical Professor of Orthopedic Surgery in the Medical Department of the University of Buffalo. 220 Franklin Street, Buffalo, N. Y.

*1887. Bradford, E. H., M.D. Visiting Surgeon to the Boston City, the Children's, and the Samaritan Hospitals; Instructor in Clinical Surgery in Harvard Medical School. *Vice-President*, 1888. *President*, 1889. 149 Newbury Street, Boston.

1889. Brackett, E. G., M.D. Assistant Surgeon to Out-patients, Children's Hospital; Physician to the Department for Nervous Diseases, Boston Dispensary; Assistant to the Department for Nervous Diseases, Boston City Hospital. 293 Marlboro Street, Boston.

*1887. Brown, Buckminster, M.D. Consulting Surgeon to the House of the Good Samaritan, Boston. 19 Marlboro Street, Boston.

*1887. Brown, Dillon, M.D. 102 E. Fifty-seventh Street, New York.

*1887. Bryant, Joseph D., M.D. Professor of Anatomy and of Clinical Surgery, and Associate Professor of Orthopedic Surgery in Bellevue Hospital Medical College; Visiting Surgeon to Bellevue and St. Vincent Hospitals; Surgeon-General National Guard. 54 W. Thirty-sixth Street, New York.

1889. Burrell, Herbert L., M.D. Surgeon to the Carney and Children's Hospitals; Surgeon to Out-patients, Boston City Hospital; Demonstrator of Surgical Appliances, Harvard University. 22 Newbury Street, Boston.

*†1887. Develin, Edward, M.D.

*1887. Foster, Charles C., M.D. Orthopedic Surgeon to the Cambridge Hospital. 5 Riedesel Avenue, Cambridge, Mass.

*1887. Gibney, V. P., M.D. Professor of Orthopedic Surgery in the New York Polyclinic; Surgeon-in-Chief to the New York Hospital for Ruptured and Crippled; Orthopedic Surgeon to the Nursery and Child's Hospital at New York. *President*, 1887. *Vice-President*, 1889. Park Avenue and Thirty-fifth Street, New York.

1889. Gillette, Arthur J., M.D. Chairman Orthopedic Section

* Original Members. † Deceased.

of the Minnesota Medical Society. 301 Pleasant Avenue, St. Paul, Minnesota.

*1887. Goodman, H. E., M.D. Attending Surgeon to the Orthopedic Hospital. 1509 Walnut Street, Philadelphia.

*1887. Hodgen, Harry, M.D. 2604 Locust Street, St. Louis.

*1887. Judson, A. B., M.D. Orthopedic Surgeon to the Out-Patient Department of the New York Hospital. *Vice-President*, 1890. *President*, 1891. 4 E. Twenty-fifth Street, New York.

*1887. Ketch, Samuel, M.D. Senior Assistant Surgeon to the New York Orthopedic Hospital; Surgeon to the Randall's Island Hospital; Clinical Professor of Orthopedic Surgery in the New York Woman's Medical College. *Corresponding Secretary*. 328 W. Twenty-ninth Street, New York.

*1887. Knickerbocker, George S., M.D. 352 W. One Hundred and Twenty-eighth Street, New York.

*1887. Lee, Benjamin, M.D. Secretary of the State Board of Health of Pennsylvania. *Vice-President*, 1889. 1532 Pine Street, Philadelphia.

*1887. Lovett, Robert W., M.D. Surgeon to the Samaritan Hospital; Assistant Out-patient Surgeon to the Children's Hospital; Out-patient Surgeon to the Carney Hospital. *Secretary*, 1889. 133 Boylston Street, Boston.

1889. McKenzie, B. E., M.D. Lecturer on Orthopedic Surgery in the Woman's Medical College; Consulting Orthopedic Surgeon to the Hospital for Sick Children, Toronto. North and Bloor Streets, West, Toronto, Canada.

*1887. Moore, James E., M.D. Professor of Orthopedic Surgery in the University of Minnesota; Orthopedic Surgeon to St. Mary's Hospital; Consulting Surgeon to the Northwestern Hospital for Women and Children. 125 Fourth Street, South, Minneapolis, Minn.

*1887. Morton, Thomas G., M.D. Professor of Orthopedic Surgery in the Philadelphia Polyclinic and College for Graduates; Surgeon to the Pennsylvania, Orthopedic, and Jewish Hospitals; Emeritus Surgeon to the Wills Ophthalmic Hospital; Consulting Surgeon to the Woman's Hospital and to the Pennsylvania Institution for the Instruction of the Blind, and to the Institution for the Deaf and Dumb; one of the Commissioners of Public Charities of the State of Pennsylvania. 1421 Chestnut Street, Philadelphia.

1889. Myers, T. Halsted, M.D. Orthopedic Surgeon to St. Luke's Hospital; Assistant Surgeon to the New York Orthopedic Dispensary; Surgeon to the Presbyterian Hospital Dispensary. 24 W. Fiftieth Street, New York.

*1887. Packard, George B., M.D. 1405 Stout Street, Denver.

*1887. Park, Roswell, M.D. Professor of Surgery in the Medical Department of the University of Buffalo; Surgeon to the Buffalo General Hospital; Consulting Surgeon to the Fitch Accident Hospital and the Buffalo Eye and Ear Infirmary. 510 Delaware Avenue, Buffalo, N. Y.

1890. Phelps, A. M., M.D. Professor of Surgery in the University of Vermont; Professor of Orthopedic Surgery in the University of the City of New York, Medical Department; Professor of Orthopedic Surgery in the Post-Graduate Medical School and Hospital; Visiting Surgeon to the Charity Hospital, New York; Consulting Surgeon to the Mary Fletcher Hospital, Burlington, Vt. 40 W. Thirty-fourth Street, New York.

*1887. Ridlon, John, M.D. Assistant Surgeon at the Vanderbilt Clinic; Consulting Surgeon to the Transfiguration Clinic, New York. 337 W. Fifty-seventh Street, New York.

*1887. Roberts, A. Sydney, M.D. 1901 Walnut Street, Philadelphia.

*1887. Ryan, George W., M.D. Clinical Lecturer on Orthopedic Surgery in the Medical College of Ohio. *Secretary*, 1890. 114 W. Ninth Street, Cincinnati.

1889. Sayre, Lewis A., M.D. Professor of Orthopedic Surgery in the Bellevue Hospital Medical College; Consulting Surgeon to the Bellevue Hospital, the Charity Hospital, and the Home for Incurables. 285 Fifth Avenue, New York.

*†1887. Sayre, Lewis Hall, M.D.

*1887. Sayre, Reginald H., M.D. Assistant to the Chair of Surgery in Bellevue Hospital Medical College; Orthopedic Surgeon to the Out-door Department of Bellevue Hospital. 285 Fifth Avenue, New York.

*1887. Schapps, John C., M.D. Clinical Assistant to the Hospital for Ruptured and Crippled, New York; Associate Surgeon to the Department of Bones and Joints in St. Mary's Hospital, Brooklyn; Orthopedic Surgeon to the Out-door Department of St. Mary's Hospital. 486 Bedford Avenue, Brooklyn.

1889. Scudder, Charles Locke, A.B., Ph. B. (Yale), M.D. (Harv.). Assistant in Clinical Surgery in Harvard University. 94 Charles Street, Boston.

*1887. Shaffer, Newton M., M.D. Attending Surgeon in Charge of the New York Orthopedic Hospital and Dispensary; Consulting Orthopedic Surgeon to St. Luke's Hospital; Consulting Sur-

geon to the New York Infirmary for Women and Children. *President*, 1888. 28 E. Thirty-eighth Street, New York.

1889. Sherman, Harry M., M.D. 705 Sutter Street, San Francisco.

*1887. Steele, A. J., M.D. Professor of Orthopedic Surgery and Diseases of the Joints in the St. Louis Post-Graduate School of Medicine; Surgeon to the Augusta Children's Hospital, St. Louis. *Vice-President*, 1890. 2825 Washington Avenue, St. Louis.

*1887. Stimson, C. W., M.D. 68 W. Fortieth Street, New York.

*1887. Taylor, C. Fayette, M.D. 201 W. Fifty-fourth Street, New York.

*1887. Taylor, Henry Ling, M.D. 201 W. Fifty-fourth Street, New York.

1889. Townsend, W. R., M.D. Lecturer on Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York; Orthopedic Surgeon to the New York Infant Asylum. Park Avenue and Thirty-fifth Street, New York.

*1887. Vance, Ap Morgan, M.D. Surgeon to the Louisville City Hospital, to Sts. Mary and Elizabeth Hospital, and to the Masonic Widows' and Orphans' Home and Infirmary. 229 W. Chestnut Street, Louisville, Ky.

1889. Weigel, L. A., M.D. Orthopedic Surgeon to the Outpatient Department of Rochester City Hospital. 54 N. Clinton Street, Rochester, N. Y.

*1887. Whitehead, W. R., M.D. 815 Fifteenth Street, Denver, Colorado.

1890. Whitman, Royal, M.D. Assistant Surgeon to Outpatients in the Hospital for Ruptured and Crippled, New York. 126 W. Fifty-ninth Street, New York.

*1887. Willard, De Forest, M.D., Ph. D. Clinical Professor of Orthopedic Surgery in the University of Pennsylvania; Surgeon to the Presbyterian Hospital; Consulting Surgeon to the White Cripples' Home, the Colored Cripples' Home, and the Home for Incurables, Philadelphia; Consulting Surgeon to the New Jersey State School for Feeble-minded Children. *President*, 1890. 1818 Chestnut Street, Philadelphia.

1890. Young, James K. Instructor in Orthopedic Surgery in the University of Pennsylvania; Attending Surgeon to the Orthopedic Department of the University Hospital. 222 S. Sixteenth Street, Philadelphia.

HONORARY MEMBERS.

ELECTED

1889. HENRY G. DAVIS, M.D., 8 Parlin Street, Everett, Mass.

1889. W. J. LITTLE, M.D., F.R.C.P. Lond., M.R.C.S. Eng., 18 Park Street, Park Lane, W., London, England.

1890. WILLIAM MACEWEN, M.D., LL.D., Professor of Clinical Surgery, and Surgeon to the Glasgow Royal Infirmary: Surgeon to the Royal Hospital for Sick Children. 3 Woodside Crescent, Glasgow, Scotland.

1889. DAVID PRINCE, M.D.*

* Deceased.

CORRESPONDING MEMBERS.

ELECTED

1890. WILLIAM ADAMS, F.R.C.S., Senior Surgeon to the Great Northern Central Hospital, and to the National Hospital for the Paralytic and Epileptic; Consulting Surgeon to the National Orthopedic Hospital. 5 Henrietta Street, Cavendish Square, W., London, England.

1889. Dr. F. BEELY, 126 Potsdamerstrasse, Berlin, Germany.

1890. Dr. A. HOFFA, Wurzburg, Germany.

1890. ROBERT JONES, F.R.C.S. Edin., Honorary Surgeon, Royal Southern Hospital; Consulting Surgeon, Manchester Ship Canal Works. 22 Great George Square, Liverpool, England.

1890. Dr. E. KERMISSON, Professeur agrégé de la Faculté de Médecine; Chirurgien de l'Hôpital des Enfants assistés. 27 Quai d'Orsay, Paris, France.

1890. Dr. SIEGFRED LEVY, Copenhagen, Denmark.

1889. Dr. ADOLF LORENZ, Vienna, Austria.

1889. HOWARD MARSH, F.R.C.S. Eng., Senior Assistant Surgeon and Lecturer on Surgery, St. Bartholomew's Hospital; Consultng Surgeon, Hospital for Sick Children, and Alexandria Hospital for Hip Disease. 30 Bruton Street, W., London, England.

1890. EDMUND OWEN, M.B., F.R.C.S., Surgeon to, and Joint Lecturer on Surgery at, St. Mary's Hospital; Senior Surgeon to the Hospital for Sick Children, Great Ormond Street. 64 Great Cumberland Place, W., London, England.

1890. Dr. PAUL REDARD, Lauréat de l'Institut; Ancien Chef de Clinique Chirurgicale de la Faculté de Médecine de Paris; Chirurgien du Dispensaire Furtado-Heine. 3 Rue de Turin, Paris, France.

1888. BERNARD ROTH, F.R.C.S. Eng., 29 Queen Anne Street, Cavendish Square, W., London, England.

1890. NOBLE SMITH, F.R.C.S. Edin., L.R.C.P. Lond., M.R.C.S. Eng., L.M.; Surgeon to All Saints Children's Hospital; Orthopedic Surgeon to British Home for Incurables. 24 Queen Anne Street, Cavendish Square, W., London, England.

1890. HUGH OWEN THOMAS, M.R.C.S. Eng., Consulting Surgeon of the Iron Ship Builders and Boiler Makers of Great Britain and Ireland. 11 Nelson Street, Great George Square, Liverpool, England.

1890. W. J. WALSHAM, F.R.C.S. Eng., M.B. and C.M. Aberdeen; Assistant Surgeon, and Surgeon in Charge of Orthopedic Department, and Lecturer on Anatomy, St. Bartholomew's Hospital; Surgeon, Metropolitan Hospital; Consulting Surgeon to Hospital for Hip Diseases, Sevenoaks, and to the Burnley Cottage Hospital. 27 Weymouth Street, Portland Place, W., London, England.

1890. GEORGE ARTHUR WRIGHT, B.A., M.B. Oxon, F.R.C.S.; Senior Assistant Surgeon, Royal Infirmary, Manchester; Surgeon to Children's Hospital, Pendelbury and Manchester. 8a St. John Street, Manchester, England.

MINUTES

OF THE

FOURTH ANNUAL MEETING

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

Held at Philadelphia, September 16, 17, and 18, 1890.

First Day—*Morning Session.*

The Association met in the Lower Hall of the College of Physicians, and was called to order by the President, Dr. De Forest Willard, at 10 o'clock.

The Treasurer reported the Association in debt to the extent of about sixty dollars, and suggested that the initiation fee be raised to twenty-five dollars. The report was referred to the Auditing Committee (Drs. R. H. Sayre and A. J. Steele).

The President appointed Dr. John Ridlon as a member of the Committee on Membership in the absence of Dr. V. P. Gibney.

It was proposed that the By-laws be so amended as to provide for the election, in the same manner as active members, of corresponding members, eligible to active membership but residing out of the United States, honorary and corresponding members to be exempt from the payment of dues.

It was proposed that the initiation fee be twenty-five dollars, and that the By-laws be amended accordingly.

The President then delivered the Annual Address.

Dr. E. H. Bradford read a paper on "The Surgical Treatment of Spastic Paralysis in Children."

Dr. A. J. Gillette read a paper on "Tenotomy for the Relief of Deformity in Spastic Paralysis."

Dr. Ap Morgan Vance read a paper on "Amputation as an Orthopedic Measure."

Afternoon Session.

The meeting was called to order by the President at 3 o'clock.

Dr. H. L. Taylor read a paper on "A Ready Method for Counter-traction at the Knee."

Dr. F. H. Milliken, of Philadelphia, by invitation, read a paper on "The Treatment of Infantile Club-foot Preliminary to Operation."

Dr. Benjamin Lee read a paper on "Sacro-iliac Disease."

Dr. R. Whitman, by invitation, read a paper on "The Treatment of Persistent Abduction of the Foot, commonly known as Chronic Sprain of the Ankle."

SECOND DAY—*Morning Session.*

The meeting was called to order by the President at 10 o'clock.

Dr. B. Lee read a paper on "The Nervous and Muscular Elements in the Causation of Idiopathic Lateral Curvature."

Dr. C. L. Scudder read a paper entitled "A Determination of the Muscular Strength of Growing Girls and its Relation to the Etiology, Treatment, and Prognosis of Cases of Lateral Curvature of the Spine."

Dr. R. W. Lovett read a paper on "The Etiology of Lateral Curvature."

Dr. A. B. Judson read a paper on "The Rotary Element in Lateral Curvature of the Spine."

The Association adjourned to visit the Orthopedic Hospital, where Dr. T. G. Morton exhibited the results of treatment of club-foot by excision of the astragalus, and an apparatus for determining asymmetry in the lower limbs.

Afternoon Session.

The meeting was called to order by the President at 3 o'clock.

Papers on the treatment of Lateral Curvature were read by Drs. Bradford, H. L. Taylor, and Judson, and the papers of the day were made the subject of prolonged discussion.

THIRD DAY—*Morning Session.*

The meeting was called to order at 10 o'clock, and Dr. Lee was elected President *pro tem.* in the absence of the President.

Dr. John Ridlon read "A Report of Sixty-two Cases of Hip Disease observed in the Practice of Hugh Owen Thomas."

Dr. R. W. Lovett read a paper on "Lateral Deviation of the Spine as a Diagnostic Symptom in Pott's Disease."

Dr. J. K. Young, of Philadelphia, by invitation, read a paper on "Diseases of the Eye associated with Caries of the Vertebræ."

Dr. Samuel Ketch read a paper on "Posterior Rachitic Curvature of the Spine."

The President resumed the Chair, and the following candidates were elected to active membership:

Dr. A. M. Phelps, of New York; Dr. Royal Whitman, of New York; and Dr. James K. Young, of Philadelphia.

As proposed at a previous meeting, it was voted that the first sentence of By-law V. be amended so as to read: "The initiation fee shall be twenty-five dollars."

As proposed at a previous meeting, it was voted that the last paragraph of By-law I. be amended by inserting the following words between the first and second sentences of the paragraph: "Corresponding members, eligible to active membership but residing out of the United States, may be chosen in the same manner as active members. Honorary and corresponding members shall not be expected to pay fees or dues."

It was voted that the proposed amendment, limiting the active membership to fifty, be taken from the table. On a vote the amendment was lost.

It was moved and carried that the Secretary be authorized to write to such members as have not attended the meetings of the Association for three consecutive years, advising them of the article of the Constitution relating to non-attendance.

It was voted that no member be considered as having attended an annual meeting unless he has registered.

The rules being suspended by a vote, the following were elected to corresponding membership:

Mr. William Adams, of London; Dr. F. Beely, of Berlin; Dr. A. Hoffa, of Wurzburg; Mr. Robert Jones, of Liverpool; Dr. E. Kirmisson, of Paris; Dr. Siegfred Levy, of Copenhagen; Dr. Adolf Lorenz, of Vienna; Mr. Howard Marsh, of London; Mr. Edmund Owen, of London; Dr. Paul Redard, of Paris; Mr. Bernard Roth, of London; Mr. Noble Smith, of London; Mr. Hugh Owen Thomas, of Liverpool; Mr. William J. Walsham, of London; Mr. George A. Wright, of Manchester, Eng.

Dr. William Macewen, of Glasgow, was elected an honorary member.

Officers of the Association were then elected as follows:

President.—Dr. A. B. Judson, of New York.

Vice-Presidents.—Dr. Ap Morgan Vance, of Louisville, and Dr. George W. Ryan, of Cincinnati.

Secretary and Treasurer.—Dr. John Ridlon, of New York.

The Association then adjourned to visit Dr. Lee's Orthopedic Gymnasium.

Afternoon Session.

The meeting was called to order by the President at 4 o'clock.

Dr. A. J. Steele read a paper on "The Relief of Paraplegia."

Dr. T. H. Myers read a paper on "The Prognosis of Pressure-paralysis."

Dr. A. B. Judson read a paper on "The Adverse Lever at the Ankle-joint."

Adjourned.

JOHN RIDLON, M.D., SECRETARY,
337 W. FIFTY-SEVENTH STREET, NEW YORK.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

NAME.

I. THIS Society shall be called the AMERICAN ORTHOPEDIC ASSOCIATION.

OBJECTS.

II. The purpose of this Association shall be the advancement of Orthopedic science and art.

MEMBERS.

III. The members shall be graduates in Medicine in good professional standing, who are especially interested in Orthopedic science and art.

Candidates for membership shall have been engaged in the practice of medicine for at least three years, and shall have given evidence of satisfactory scientific attainments.

FORFEITURE OF MEMBERSHIP.

IV. The Association shall have power to declare forfeiture of membership in case of any member who ceases to exhibit an active interest in the science of Orthopedic Surgery. Any active member of the Association who shall absent himself from three consecutive annual meetings shall be dropped from the roll of membership, unless he shall be able to give satisfactory reasons to the Association for his dereliction.

BY-LAWS.

ELECTION OF MEMBERS.

I. There shall be a Committee on Membership, consisting of five. All nominations shall be made in open meeting by two members of the Association, and shall be referred to the Committee on Membership, who may report on each name as they shall think proper; such report to be made at the next annual meeting following that at which the nomination is made. But the proposers of any member may, after the report of this Committee has been received, bring such name before the Association.

The Secretary shall soon after each annual meeting send to each member of the Association a list of the names of all candidates proposed for membership, together with the names of the proposers and of the members of the Committee on Membership.

A vote of three-fourths of the members present at an annual meeting shall be requisite to an election.

The election shall be by ballot.

Every member shall sign the Constitution and By-laws.

Honorary members may be chosen by the Association in the same manner as active members. Corresponding members, eligible to active membership but residing out of the United States, may be chosen in the same manner as active members. Honorary and corresponding members shall not be expected to pay fees or dues. They shall enjoy all the privileges of active members, except voting and election to office and appointment on Business Committees. They shall, if practicable, sign the Constitution and By-laws.

OFFICERS.

II. The officers shall be a President, two Vice-Presidents, and a Recording Secretary, who shall also be Treasurer. Their terms of office shall be for one year. There shall be a Corresponding Secretary, whose term of office shall continue from year to year, unless limited by the Association.

The President shall conduct the meetings of the Association.

The Recording Secretary shall keep the minutes, carry out the instructions of the Association in respect to its *Transactions*, and call its meetings. He shall also take charge of moneys for the Association.

The Corresponding Secretary shall conduct all foreign correspondence.

The President and Recording Secretary shall be elected at the close of each annual meeting, to manage the affairs of the Association during the interim, and to serve at the ensuing meeting.

MEETINGS.

III. The Association shall hold its meetings annually on the third Tuesday of September, at such place as may be determined; the time and place of meeting to be advertised by the Secretary, and notice to be sent to members. Eight members shall constitute a quorum.

PROCEEDINGS.

IV. The proceedings of the Association shall be issued in pamphlet form.

There shall be a Publication Committee of two to act in connection with the Recording Secretary in publishing the *Transactions*.

FEES.

V. The initiation fee shall be twenty-five dollars; the annual dues fifteen dollars.

EXPULSION OF MEMBERS.

VI. Any member may be expelled for cause by a three-fourths vote of those present at any annual meeting.

No action in matters of discipline shall be taken at any session of an annual meeting at which there shall be present less than three-fourths of the members registered as attending such annual meeting. A vote of three-fourth of the members thus present shall be necessary for expulsion.

ORDER OF BUSINESS.

VII. The following shall be the order of business at the annual meetings of the Association:

1. Reading records of previous meeting.
2. Appointment of Committees.
3. Report of Treasurer.
4. Report of Committees.
5. Election of new members.
6. Written communications.
7. Stated discussions.
8. Verbal communications.
9. Incidental business.

ALTERATIONS OF BY-LAWS.

VIII. A vote of three-fourths of the members present at any annual meeting shall be requisite for an alteration of the Constitution.

A vote of a majority of the members present at an annual meeting shall be requisite for an alteration of the By-laws.

Propositions to amend or alter the Constitution or By-laws must be made at one session of the annual meeting, and acted upon at a subsequent session of the same annual meeting.

STANDING RULES.

I. Whenever a candidate is proposed for membership, both the proposer and seconder shall furnish letters setting forth the claims of such candidate for membership.

II. Names of members in arrears to the Association for three years shall be stricken from the list three months after the notification of this rule has been served upon such members, except in the case of those absent from the country.

III. The Secretary shall, about April 1, send a request to each member to forward the titles of such papers, specimens, or apparatus as he desires to present at the next meeting of the Association.

Such titles shall be incorporated by the Secretary in the printed call for the meeting, and these papers shall have precedence over all others.

IV. Twenty minutes shall be the maximum time allotted to the reading of any paper, unless by special vote of the Association in each case and by a two-thirds majority. Any paper requiring more than twenty minutes for its reading shall be presented in abstract under the same limitation to twenty minutes.

V. The Publication Committee may receive for publication in the *Transactions* any paper the title of which appears upon the programme of a stated meeting.

VI. All essays and contributions, the titles of which have been sent and accepted by the Association for use at its meetings, shall be the property of the Association, and shall not be published or used for other purposes without the consent of the Executive Committee.

VII. All papers and other communications intended for publication shall be placed in the hands of the Secretary before November 1st; proofs of the same shall be sent to the several writers, returnable within two weeks. In case of non-compliance with this rule, any paper may be omitted from the published *Transactions* at the discretion of the Publishing Committee.

VIII. The President and Recording Secretary shall not have power to incur any debts for the Association exceeding in total the sum of one hundred dollars, unless especially authorized to do so by the recorded vote of the Association.

IX. All proceedings of the Association, not specified, shall be in accordance with the Manual of the House of Representatives.

X. No member is to be considered as having attended an annual meeting unless he has registered.

THE PRESIDENT'S ADDRESS.

By De FOREST WILLARD, A.M., M.D., Ph.D.,
PHILADELPHIA.

Fellow-members: As an individual, a Philadelphian, and especially as President of the American Orthopedic Association, it is my pleasure to welcome you to this city, which for more than a hundred years has been properly regarded as a centre of medical education, and as the home of surgeons who have given careful and thorough attention to their professional work.

I trust that our meeting this year will add much valuable material to that which has already been collected during the three years of our existence. To make our Association strong and valuable, each member must do his whole part; all minor interests and petty differences must be put aside, and we must work unitedly in order to secure the proper advancement of scientific work. Each year must show an increase in the ability and in the character of our productions.

Our Association has reason to be proud of the publication during the year of an American work upon Orthopedic Surgery by two of our members, which treatise is especially to be commended for the thoroughness and scope of its contents, and from the fact that it justly recognizes the great assistance capable of being rendered in many classes of deformities by the combined efforts of the skilled application of scientific surgery and the careful adaptation of mechanical devices. It enlarges the scope of orthopedic surgical work, and shows the great advantage and speedy results to be obtained by one who realizes that orthopedic surgery does not consist in the mere application of apparatus. Scientific surgery is capable of accomplishing so much that no one can afford to neglect the great advantages to be secured by its proper and judicious employment.

As I have been but a few days upon land, and especially as I look upon the good material which the programme offers for your instruc-

tion, I feel it a kindness to ask your attention for a few minutes only to some points in our own especial work across the ocean, rather than to tax your time and patience with a set presidential address.

It had also been my intention, instead of delivering an address, to exhibit some apparatus and appliances that I obtained abroad, but as these are still upon the briny deep, to demonstrate them would be like delivering a clinical lecture without a patient; consequently, a few words in regard to orthopedic matters in Europe may not be amiss, and they may interest those who were not present at the International Congress in Berlin this summer.

In congratulating the American Orthopedic Association upon its work, we have to record the fact already known, that for the first time in the history of international congresses a special sub-section was entirely devoted to the interests of orthopedic surgery as distinguished from general surgery.

In regard to the science of orthopedic surgery in Europe, I regret to say that I found it in a far less advanced state than I had anticipated. Without taking too much credit to ourselves, we are justified in saying that, with a few notable exceptions, our branch stands far ahead of our European brethren, both in its surgical aspects and in the ingenuity of its mechanical contrivances. The condition is certainly not satisfactory to those who insist that orthopedic surgery should be purely a specialty and not a branch of general surgery, since such admirable work is being done by general surgeons. Many orthopedic specialists are doing surgery which we would consider very crude, and not at all in accord with the great surgical advances of the past few years.

In some other cases the special work requiring massage, electricity, gymnastics, etc., showed the same tendency toward degeneration into a business aspect that is the great danger in our own country.

The chief reason for the lack of proper advancement seemed to me to lie in the fact that the pure specialist had failed to realize that the science of true orthopedic surgery demanded the exercise of the highest skill in both surgical and mechanical measures. Until this broad ground is taken, orthopedic surgery will not attain the rank that it deserves. Personally, I cannot understand why the mechanical element should be exalted to undue proportions in the study of our special branch, when it offers results in no way superior to,

and often far less prompt than those obtained by a judicious combination of both surgical and mechanical measures.

I think that I voice the sentiment of the most advanced American orthopedic surgeons when I say that while the judicious, careful, and accurate adaptation of mechanical measures is of the greatest importance in the management of deformities and of joint diseases, yet the treatment cannot be rightly carried out, nor the surgical complications and dangers properly appreciated by one who is not conversant with all the indications. To treat properly such conditions the attendant should be thoroughly qualified to carry the case to its completion, even though such completion necessitates the most serious of operative procedures.

Among the general surgeons in Europe, such men as Macewen, Edmund Owen, Howard Marsh, and others, are doing excellent work. To the former we must all accord great praise, since to his efforts is due the advancing interest in osteotomy. By the introduction of this beneficent operative measure, cases which formerly (especially among the poor) were permitted to remain hopeless and helpless cripples, are now safely and easily made self-supporting and strong individuals.

I was also exceedingly pleased with Macewen's strong and earnest advocacy of laminectomy, and other operations which promise to give relief and assistance in at least a certain number of cases of caries of the spine with pressure-paralysis. His note of warning recently uttered, however, is timely, and it must be remembered that he does not claim that it is an operation to be attempted indiscriminately or frequently, since the large majority of cases are curable by other measures. His paper before the Berlin Congress was an argument in favor of the extension of osteotomy to the pelvis.

The apparatus of Dr. Beely for the correction of lateral curvature by weights applied to the projecting portions of the thorax and loins, is a valuable adjunct to our mechanical measures for treating this most troublesome condition.

The gymnastic and movement cure for lateral curvature of the spine, in the hands of Roth, Beely, Lorenz, and others, is making good and legitimate advances.

In Germany some of the general surgeons are also doing good orthopedic work.

Mechanical massage is not largely employed, although there are

institutions for the purpose in Berlin, Baden, Frankfort, and other places.

Zander's institution, in London, has passed into the hands of a regularly advertising concern.

In London, at the Alexandria Hospital, under the care of Mr. Howard Marsh and others, the curative powers which Nature, combined with good food and fresh air, is capable of accomplishing in hip-disease, together with the comfort afforded by horizontal traction for an indefinite length of time with weight and pulley, were well illustrated. I have never seen any set of children afflicted with hip-disease looking so hearty, robust, and healthful as were those there assembled. While I had not the opportunity of investigating results, yet the appearance of the children was, in itself, a most encouraging stimulant in the direction of rest and non-operative interference.

My observations certainly strengthened my convictions that an orthopedic surgeon should possess a most thorough theoretical and practical knowledge in the line of surgery. He must have thorough surgical skill and attainments, and then must add thereto the study of the mechanical means and contrivances necessary to accomplish the desired end. Special study in the latter direction is rarely attempted, or rarely grasped, by the general surgeon, who relies alone upon his surgical skill. Hence, the two lines must be patiently travelled by the orthopedic surgeon who would have a thorough understanding of the requirements of his patients.

The tendency of the majority of the papers read before the Orthopedic Section of the Congress was toward the surgical side of orthopedic work, rather than that of the mechanical side.

In the exhibition connected with the Congress various appliances and apparatus were shown. The most novel idea associated with our work was that of Dr. Gluck, showing his proposed method of replacing excised portions of the bones by ivory joints, which are intended to remain *in situ*, and to maintain the proper functions of the limb.[1]

I have here a few specimens of the joints in question. They consist of pieces of ivory articulated ingeniously so as to represent

[1] Die Invaginations-Methode der Osteo- und Arthro-plastik. Berlin Med. Gesellschaft, July 2, 1890. Seperat-abdr. aus Berliner klin. Wochenschrift, No. 32, 1890. Also, Transactions Tenth International Congress.

various joints of the body. I saw several of his cases, of which he states he has had fourteen in all, but a number of them have been replacements in the continuity of bones, and the success of the method is still uncertain. The force which he employs in driving these pieces of ivory into the medullary cavity of the bone is very great, as he does not bore a passage for them, and, in two of his cases which I saw, fracture had resulted. In one case removal of the artificial elbow had become necessary, as it had loosened; while in another case, at the knee, the ivory joint had protruded. He, however, persisted in retaining it *in situ*, and was endeavoring to cause granulations to cover it. The subject is still in its experimental stage; and while I am strongly inclined to test the advisability of inserting ivory in the continuity of bone for ununited fracture and similar conditions, and while his experience has not resulted in any serious inflammatory trouble, yet I still believe that excision of the knee resulting in a stiff member (which is not any serious detriment to locomotion) is preferable to the artificial joint which he proposes to establish. An artificial joint at the elbow is often secured after an ordinary excision, and I am still inclined to think that it would be fully as useful as an ivory one. In truth, I must report that I did not see any of his cases where the joint had thoroughly healed over, although in his insertions in the continuity of bone thorough union had occurred.

I regret to say that within the year death has diminished our numbers by taking from us one of our most enthusiastic workers, our first secretary, Dr. Lewis Hall Sayre, at the age of thirty-eight years. He was a graduate of Bellevue Hospital Medical College in 1876, to which institution, at the time of his death, he was Assistant Orthopedic Surgeon. He was also Consulting Surgeon to the Hackensack Hospital. He was a member of various city, state, and national medical associations, and President of the Bellevue Alumni Society. His death was sudden, and was supposed to be cardiac. He had been working most energetically and satisfactorily in our branch of the profession, and had given good evidence of his skill and talents in this particular line. It is to be regretted that the profession was called upon to lose so earnest a member, and we tender to the members of his distinguished family our most sincere sympathy.

Also, in December, 1889, we were regretfully called upon to record the loss of our Honorary Member, David Prince, M.D., of Jacksonville, Ill. He was born in Connecticut, in 1816. He lived a long and useful life, and was one of the pioneers of orthopedic surgery. His articles and book, published many years since, show careful thought and consideration of the subject upon which he was engaged. He was graduated in Cincinnati, and for many years lectured in St. Louis. He was the first surgeon in Illinois to use ether in surgical operations.

I will not detain you further from the more palatable food which awaits you upon our programme, but will only again tender you a hearty welcome to all the hospitalities of the City of Brotherly Love. I trust that the few days of your stay with us will not only be profitable, but pleasant, and that each and all of the members of our profession here, as well as those engaged in our special work, will render you all the courtesies that may lie in their power.

THE SURGICAL TREATMENT OF SPASTIC PARALYSIS IN CHILDREN.

By E. H. BRADFORD, M.D.,
BOSTON.

Among the so-called paralyses of children is one affection which, though well marked in type, has, until recently, received but little attention. Spastic or cerebral paralysis in children has remained almost neglected by orthopedic surgical writers. This fact is the more surprising, as the disease gives occasion to a marked awkwardness in gait and to deformity second only to that following infantile paralysis. The explanation for this omission may be given by the fact that, until recently, the affection was but little understood. Fortunately, this is not the case at present, and, although the pathology of the disorder is as yet somewhat of a mystery, yet, thanks to a number of recent writers, there is no difficulty to be met in recognizing the affection and estimating its clinical history and probable course.

The disease is in no sense a true paralysis. There is in typical cases at the early stages no loss of power of the muscles, but the patient is unable to use the limb, not from any lack of strength so much as an inability to control or coördinate muscular action. This condition of things is limited to certain groups of muscles, usually those of the lower extremities, sometimes also of the upper extremities. In some instances only one upper extremity and one lower extremity, in others simply one lower extremity, is affected. In one exceptional case, the forearm of the right hand and some of the muscles of the tongue were affected, while all other muscles were normal. In many instances the disease is combined with an impairment of intelligence. Frequently, however, the intelligence is unusually good.

Where both limbs are affected, this condition is doubly trying; and when the adductor muscles are also involved, the limbs are crossed and the gait becomes very difficult, a degeneration of the muscles takes place and they become permanently affected; atrophy of other muscles also occurs, and the limbs become wasted. But, ordinarily, there is not during childhood much wasting of the muscles, and they are peculiarly firm to the touch, even when not in use.

Characteristic of the affection, in contrast to infantile paralysis, is the presence of exaggerated knee-reflex, which is always present.

The affection is supposed to be congenital, but is frequently not noticed by parents until after the child begins to walk.

In some instances a large number of the muscles of the trunk and the extremities are involved. In one instance the bladder was affected, attacks of incontinence of urine occurring; but usually the rectum and bladder are not affected. In one case there was an apparent paralysis of the nerves controlling the perspiration on one side of the face. The affection is usually accompanied by a certain amount of nervousness of disposition, excitability; in other instances, however, the patients are of a calm temperament. It has been said to result from some injury at the birth of the patient; but this has not been proved, and in the majority of cases which the writer has seen, the birth was perfectly normal. In one instance, that of an idiot, a spastic condition of the muscles of the forearm appeared to be due to an injury by the pressure of forceps at birth.

Where no defect of intelligence is present, if the children are often of a nervous or excitable disposition, they are managed with difficulty. Even in the lighter cases, the children are often deprived of an ability to play about with their companions; they are prevented from forming friendships, and lose the education which comes in that way and which is of great value in developing character. Where the affection is more extensive, and locomotion becomes difficult, children prefer to remain sitting, rather than to move about actively, particularly if all their wants are supplied by parents. They, therefore, become more helpless from inactivity than they would be simply from the natural defect. Walking is labored, and the children move about as little as possible. In the severest cases,

the children's state is unusually deplorable. They are practically helpless, although their general health may be good.

Where this condition is accompanied by idiocy, the condition is hopeless; but in those cases where the mental intelligence is really good, but has been entirely undeveloped by the circumstances accompanying growth, the state is particularly lamentable. In the other cases, where the children are able to go about readily, the awkwardness of their gait makes them frequently objects of derision among their companions, and that in itself sometimes, in sensitive children, is an impairment to their complete growth in mental qualities.

The gait in walking is characteristic, and is seen in no other affection. The heel is not placed upon the ground, the knee is bent, and the knee is thrown to the inner side. When both limbs are affected, the gait is a peculiarly springing one, as if the patient was as desirous as possible of resting on one foot as little as he could. The limbs are dragged one over the other, and the feet sometimes turn slightly in, or less frequently they may be turned out. Occasionally the patient can walk naturally for a step or two, but when excited, in play or in ordinary walking, they will twist the limbs more violently.

In the severest cases one limb crosses another, so that it is with difficulty that the patient stands. Where the upper extremities are affected, the thumb is usually pressed upon the ball of the hand and the fingers flexed. The hand turns in, and the forearm rotates inward, whenever there is any attempt to move the arm. The muscles at times may be soft, and the hands, when at rest, in good shape and position. In some instances, when the patient is at rest, the muscles of the lower extremities are soft to the touch, and gentle passive and active motions are normal; but motion following nervous effort or excitement is accompanied by spasm.

The pathology of this affection is not definitely understood further than there is reason to believe that it is due to some affection, defect, or injury to parts of the motor centres or to the cortex of the brain, accompanied in many instances by degeneration of the lateral column of the spinal cord. But this portion of the subject can better be left to the researches and investigations of the neurologist.

The important subject of treatment has been considered by the

neurologists, and their reports are not encouraging. Neither the administration of drugs nor electricity is of use; massage is of doubtful benefit. The careful education of patients, and muscular training carried out persistently, are, however, of advantage, and some improvement is to be gained in this way. But the number of cases where such treatment is feasible or advisable is few, and the amount which can be gained in the severe cases is slight.

The use of appliances naturally suggests itself as a ready means of correcting the deformities assumed in spastic paralysis resulting from the defective muscles; but a thorough attempt of this method of treatment will demonstrate that it is practically useless, except in cases that are very unusual.

Although it is an easy matter to devise such appliances as will prevent the limbs from assuming an attitude of deformity, yet the deformity recurs whenever the appliance is taken off. Furthermore, an appliance of great strength is necessary to resist the action of the strong muscles when the patient is of any size; for that reason it will be found that an apparatus is cumbersome, and prevents, rather than aids, locomotion. And it has been found that (unlike the condition of muscles seen in infantile paralysis) the muscles cannot be stretched so that the deformities become permanently corrected. Hence, the treatment by mechanical appliances will not be found of any permanent value.

Perhaps, in the future, when surgery of the brain has been more advanced, it may be possible to attack in a few of these cases the central nerve lesion. At present, however, such a proposition is not justified. In a case reported by Dr. Bullard and by the writer, trephining was done over the motor centre of the right arm, for the reason that it was manifest that there had been bone pressure on the skull, occurring in an idiot who was certainly injured at birth by the use of forceps. The operation revealed a cortical cyst in this region; but the case terminated fatally, and cannot be quoted as a precedent for future operation.

The neurologists, as a rule, have not given their sanction to tenotomy in spastic paralysis, and some are emphatically opposed to it, the objection which has been urged against the treatment by operation being that, as the affection is not a contraction of the muscles, but a defect of the brain centres, all that an operation could

do would be to weaken the muscles without altering the central conditions.

Although this objection is theoretically plausible, against it can be urged recent practical experience. It has been abundantly proved that tenotomy does not injure the muscles, and it cannot rightly be said to weaken the muscles. The monograph by Rupprecht would seem to be sufficient to establish this point, substantiated as it is by the experience of other surgeons.

It may be said, also theoretically, that although central brain trouble exists, yet the condition of the muscles suggests that the muscles are too powerful to respond readily to the brain influence, and that something is needed to enable the central nervous force to compel obedience of the muscles.

What tenotomy actually does in these cases on the structure of a muscle is not definitely understood. It certainly overcomes the contraction, and in spasmodically-contracted muscles it would appear that it prevents the possibility of permanent spasms. Whether this is done by lengthening the muscles or by weakening, it is impossible to say; but neither tenotomy nor myotomy permamently injures a muscle.

Furthermore, not only tenotomy, but also myotomy, appears to be of advantage in these cases in enabling the patient to overcome the resistant tonic spasm in certain muscles which interfere with locomotion.

The writer does not attempt a physiological explanation of the fact, but bases his opinion on his experience in 14 cases of varying severity. In 6 of these simple tenotomy of the tendo-Achillis was performed. In 4 tenotomy of the tendo-Achillis and section of the hamstring tendons were done. In 4 myotomy of the adductors was done, in addition to the section of the hamstrings and tendo-Achillis.

The cases operated upon were all children, and in no case had the muscles degenerated from disease to the extent that they were not powerful, and in all was the operation amply justified by the results obtained.

When the tendo-Achillis alone was to be divided, the procedure employed was the usual one of subcutaneous tenotomy followed by fixation of the foot in a position at right-angles to the axis of the leg, and, later, by the retention of the foot by a light appliance to

prevent dropping of the front of the foot, this appliance to be worn for a few months.

If the foot be over-corrected, there appears to be in this affection greater danger of a resulting calcaneus than after tenotomy of the tendo-Achillis, after congenital club-foot, or from infantile paralysis (anterior polio-myelitis). If, however, care not to over-correct is used in fixing the limb, little danger of calcaneus is to be anticipated.

Although subcutaneous division has been used in one or two of the cases of section of the hamstrings and adductor muscles, I have of late been led to prefer open incisions (under aseptic precautions), on account of the greater precision possible.

The place of incision necessarily varies, whether the part which is to be divided is in the knee or the groin. In the knee the patient is placed on the face, after the skin is thoroughly cleaned; an oblique incision is made reaching from one side of the popliteal space to the other, running across the tendons of the outer and inner hamstring muscles. The tendons are then carefully divided by transverse or oblique incisions. The limb is then made straight and the wound closed by a suture, and an aseptic dressing is applied. If the tendo-Achillis has also been divided, the foot is also placed straight. Where the adductor muscles are to be divided, they are incised near their insertion at the groin. This can be done with the tenotome or an open incision. The latter I have preferred, as it enables the surgeon to limit carefully the extent of the myotomy. The patient is placed upon the back, and an assistant abducts the leg as far as is possible; a straight incision is made through the skin just below the insertion of the muscle at the pubis, directly over the inner border of the adductor muscle, made tense by the forcible adduction of the limb. The skin incision is separated by hooks, and the adductor muscle divided by a cross-cut as extensively as may seem advisable. I have usually divided the muscle more or less completely, according to the amount of the spasm, which can be more readily estimated from the fact that in these cases I have found that a complete relaxation of the affected muscles does not take place, even although all the usual symptoms of complete anæsthesia from ether are present in the other muscles of the body, as well as in the absence of sensitiveness of the cornea.

The incision through the skin can be closed by suture, and the wound allowed to heal by first intention.

Immediately after the operation the limb should be fixed in a corrected position. The patient should be kept in bed for a few days, but after this the patient may be allowed to sit in a chair. After ten days or a fortnight the splint may be removed and the patient allowed to go about on crutches, or with an appliance similar to what is used in infantile paralysis. Some sort of an appliance will be necessary, usually for six or seven months.

The muscles, at first, may be regarded as weakened by the operation, but they entirely recover their power. As far as my experience goes, there is no danger of a relapse if the operation has been thoroughly done. In a few cases, where the hamstring muscles are imperfectly divided, a slight tendency to a recurrence of flexion has been noticed.

In the cases I have observed the benefit gained by operative interference was so marked that I think it possible that something may be gained by careful myotomy of the muscles in the upper extremity. This will require careful examination of the muscles involved, and will have to be the subject for further investigation. From evidence that has already been gained, it would appear that in this form of the affection tenotomy or division of the muscles relieves one of the obstacles to successful use of the limbs, when the lower extremity is involved and where what may be termed the obstinacy of the muscles interferes with locomotion. Where there is spasm at the tendo-Achillis, this can invariably be corrected; and the same is true in spasmodic contraction at the knee, and in spasmodic adduction if myotomy has been thorough. But it is a matter requiring some judgment as to how thorough a division will be needful.

I have operated on no cases of spastic paralysis where contraction of the muscles had been followed by complete fibrous degeneration; although, if tenotomy is beneficial in infantile paralysis under these circumstances, it would probably be equally so in cerebral paralysis.

In the most severe case that has come under my care, all the limbs and a portion of the face were affected. The mental intelligence was remarkably good. Both arms and hands were badly affected, but the patient was able to use his crutches by the use of the pectoral and a few of the unaffected muscles. The child could walk

about, on crutches, but the lower extremities were very badly distorted and locomotion was much impeded. This condition was corrected by operation, and the boy became able to walk about with crutches without being interfered with by spasmodic twitchings and incoordination of the limbs, and with the limbs in a normal position.

Where marked mental impairment exists, little or no benefit is to be expected from operative treatment; and in adult cases, persistent since early childhood, but little benefit can be expected in severe cases.

A CASE OF TENOTOMY FOR THE RELIEF OF DEFORMITY IN SPASTIC PARALYSIS.

By ARTHUR J. GILLETTE, M.D.,
ST. PAUL, MINN.

A GIRL, aged eleven and a half years, suffering with a badly-deformed leg and arm, the deformity being the right forearm flexed upon the arm. Whenever excited the muscles of the arm became rigid, as did the fingers of the hand of the same arm.

The right foot was in the position of talipes equinus, and when she attempted to walk, and the weight was thrown on the foot, it was brought into the position of talipes equino-varus. (See Fig. 1.)

The toes, whenever irritated, or the foot moved, or the child in any way excited, were immediately drawn into the position of hammer-toes to such a degree that the mother at times was unable to put on the child's shoe or stocking. The spasm, however, of fingers and toes entirely disappeared when the child was asleep: but the talipes equinus remained the same, leading one to believe that there was a real structural change in the calf muscles, due to the long-continued abnormal position and the usual changes occurring from paralysis.

At one time this child was treated with a club-foot shoe. She wore this brace until sores formed to such an extent that she could no longer endure the pain.

An aunt on the mother's side suffers from epilepsy; no other evidence of nervous trouble has been found in the family of either parent.

Her health was perfect until her second year. In the second month of the third year she complained of pain in her head, which was shortly followed by vomiting. Two days after this she had a convulsion, quickly succeeded by others, for the space of twenty-four

hours. During this period she was in a semi-conscious condition. After the cessation of the convulsions she became totally unconscious, remaining so for six or eight weeks. She then gradually

Fig. 1.

Fig. 2.

came to herself, and for three weeks after her return to consciousness she was unable to talk. When she began to speak, she did so with great effort.

The right side, including the face, was paralyzed from the very first.

At the time of the seizure the pupil of the right eye was greatly dilated and did not react to light; the left arm participated in the convulsive movements, but not the left leg.

After the expiration of a year she became able to walk, her gait being similar to the hemiplegic walk of an adult.

Wishing to know her exact nervous condition, I sent her to Dr. C. Eugene Riggs, whose information will be found in the following letter:

"My dear Dr. Gillette: I have just examined with great interest your little patient, whom you have so courteously referred to me for my opinion. She presents a perfect clinical picture of cerebral infantile palsy of the hemiplegic variety. There is marked mental impairment, though not so marked as that usually found in the paraplegic and diaplegic types of this disease. The child has shown decided athetosis with choreiform movements. There is pronounced contraction of the flexor muscles of the hand, and the forearm is semiflexed on the arm.

"Talipes equino-varus exists to an intense degree, practically unfitting the child for walking. The contracture of the calf muscles I believe to have passed the stage of spasm and to be due to a real change in the muscular tissue. The muscles of the arm and the leg present the normal muscular formula.

"It is worthy of note that the trophic disturbances in the leg are as extreme as those that are found in myelitis of the anterior cornua.

"Very truly yours,

"C. Eugene Riggs."

I instructed the parents that a brace would be of no use, and that possibly by dividing the tendo-Achillis and any other tendons that might from their contraction hold the foot in this position—which ones I could not say until after the patient was etherized—I might be able to improve the condition of their child. Then, by applying a retention-shoe I hoped to be able to hold the foot in the proper position.

When I etherized the patient I was not surprised to see the con-

tracted condition of all the muscles disappear, excepting the calf muscles. I divided the tendo-Achillis, which permitted the foot to come into good position. It also relieved the slight flexion in the knee, which I had forgotten to mention. I then placed the foot in plaster-of-Paris and allowed it to remain there for a few weeks, the child playing and walking as much as she desired. When I removed the plaster I applied an ordinary ankle-brace with a "stop joint," to prevent the foot from returning to its former position.

It is now passed eight months since the operation, and the child has not had the slightest spasm of any of the muscles of the foot. The ankle-joint will permit of almost the normal movements, and she walks with but a slight limp. (See Fig. 2.)

DISCUSSION.

Dr. Reginald H. Sayre, of New York.—I am very glad to hear the views Dr. Bradford has advanced on this subject. I have seen a great many of these cases, and I, perhaps, see more of them than most orthopedic surgeons, because a great many are sent to my father from different parts of the country on account of the various articles which he has written on the subject.

I was a little surprised to hear Dr. Bradford say that he did not think massage and electricity were of much moment, because that has not been my experience. I find in those cases that have done well that massage was a very great assistance, and I find faradism especially useful in the exercise which it gives to those muscles which the patient is not able to move voluntarily. By the use of the current you can make artificial contractions of these muscles, and in this way increase their growth when the patient is unable voluntarily to coördinate his movements, and it seems to me that in this way we may account for a large portion of the benefit derived from faradization. I have used both faradization and galvanization in these cases, and I think both have their benefits. But, in addition to this, the training of the muscular sense of the child is very essential. Perhaps I did not understand Dr. Bradford correctly about the use of massage. He may have limited it to a narrower

field than that which I include under that head; and it is possible that we use the same measures, only we do not use the same terms.

The fact that in profound anæsthesia you very often do not get any relaxation of the contractured tissues, is very marked. I have seen patients under the profoundest anæsthesia, where all the strength that could safely be put forth without danger of fracturing the femur failed to make any perceptible impression on the hamstrings. If it is impossible to straighten a knee under profound anæsthesia, it is simply a matter of common-sense to divide the contractured tissues and put the limb in a better position to support the weight of the body. If you can put it in a straight line, you will enable the child to walk better. Tenotomy does not improve the disease of its brain and spinal cord, but it enables the child to move to greater advantage such muscles as are unaffected by the disease, and in that way it is of great assistance.

The reason, it seems to me, that mechanical appliances are almost always of very limited use is the fact that we are dealing with a want of coördinating power. The artificial muscles will act, but not under the control of the will; they are incapable of performing the various impressions our brain makes our ordinary muscles to perform in order to move with precision. For that reason we have never been able to do much with mechanical means.

It seems to me that the part played by peripheral irritation of any sort in increasing the hyperexcitability of the cord in these sclerotic cases has been underestimated by many.

I remember several cases distinctly which came under my father's observation, they having been referred to him by different physicians, where there were peripheral lesions found. These happened to be lesions of the genital organs. I have seen marked benefit accrue on removing the source of irritation or lesion.

I presented, some years ago, to the New York Orthopedic Society a boy who had congenital spastic paralysis affecting both lower limbs. I did not do a tenotomy on him. I found that by forcible stretching I could bring the toes near his shins, although a great deal of force was required. His adductors and hamstrings were markedly contracted. I thought that, before doing anything else, I would try the experiment of relieving the adhesions around his prepuce. He did not have a tight phimosis. You could retract

the foreskin for some distance, but there were numerous adhesions all around the corona, and his aunt gave a history of his making remarkable contortions every time he urinated, it taking him sometimes half an hour perhaps to complete the act. He would get into a position of opisthotonos before being able to pass his water. The frænum was nicked and the adhesions broken down, and the boy put to bed. After the irritation caused by the operation had subsided, he was able to pass water without disturbance, and he was very much improved and quieted in his whole nervous system. When I first saw him he was unable to do anything but sit on the floor. He could not dress or undress himself. He could not feed himself. If turned over on the floor, he could not turn to the other side. He could not climb up into a chair. I think he could wipe his nose with the back of his hand, but that was the extent of his power. After the prepuce was healed, his legs were manipulated and stretched daily, and faradism employed three times a week. After a course of treatment of two months, I showed him to the Orthopedic Society. He was able to get in and out of bed with assistance. With two sticks or canes he could walk twice around the room, and he could take a half-dozen steps without assistance. He fed himself, he walked up and down stairs holding on to the balusters, and he was much quieter and more composed in mind. A gentleman who saw him at this meeting suggested that his improved condition was due to the fact that a curious change came over the nervous system at twelve years of age (that being the age of the boy), and that this change which comes over the nervous system at this age was the reason of his marked improvement rather than the removal of the adhesions around his glans. That is a matter of opinion.

Another thing which was remarkable to me, and which I did not precisely account for, was the fact that exaggerated patellar-tendon reflex and ankle clonus, which were marked before the operation, had almost disappeared.

In another case, a child about eight months old when I first saw her—one of premature birth—there was the typical rabbit-face and the usual appearance of spastic paralysis—legs crossing each other, with feet firmly held in the position of equinus. In that child, before doing tenotomy or anything else, on account of the excessively

irritated condition of her clitoris, my father decided to remove that first of all, which was done; and after this the nurse was instructed to massage and exercise the child. That child had remarkable ankle-clonus and exaggerated patellar-tendon reflex. I did not believe that the child had enough brain-substance to develop into anything, but, to my surprise, she steadily improved. She stopped crying and fussing, and within a week or so after the operation she allowed the nurse to put on a diaper, which she previously could not do without a great deal of trouble. She has no ankle-clonus and no increased patellar-tendon reflex at present, three years after operation. She walks very well around the room, runs and plays, and, to a non-medical observer, the child would simply appear a little clumsy.

In many of these cases I have seen very beneficial results derived from the removal of these peripheral irritations. I believe that if a child had a granulatedlid, the relief of the lid would be an advantageous thing.

A great many people have the idea that my father said that spastic paralysis is simply the result of some abnormal condition of the genital organs. If you have a cerebral defect, if you have a child with a sclerotic brain and spinal cord, that sclerosis is not to be taken away by removal of the adhesions around the prepuce, but the child's defective nervous system is put in a much better condition by the removal of any outside irritation which is disturbing it.

We know by experiments upon animals that irritation of the kidney and compression of the testicle will produce paralysis and lack of coördinating power in the lower extremities, and I see no reason by analogy why these peripheral irritative effects on the human being should not be capable of setting up reflex irritation in the spinal cord, which is partly accountable for these spastic paralyses.

It seems to me that the case of Dr. Gillette does not have the typical position of the leg which I have seen in these cases. I rarely see them with the big toe bent up in the position shown. It looks like the late form of spastic paralysis which follows hemiplegia. Of course, the photograph which has been passed around may be deceptive. I think Dr. Gillette said that the anterior shin muscles at the time seemed to the gentleman who examined them electrically to

have the reactions looked for in anterior poliomyelitis. I would like to know if, after the muscles were exercised and given a chance to work, whether they recovered, because in these cases you very often find that if the opposing power is taken away the muscles which are put in a position to act will regain their normal condition a good deal.

Dr. A. B. Judson, of New York.—I recognize the difficulty of stretching the muscles in these cases, but a great deal can be done mechanically by taking advantage of the weight of the body, which acts so unfavorably in the production of the deformities of orthopedic patients, and is such an obstinate opponent to our treatment in many cases.

While Dr. Bradford's paper was being read, I recalled a patient to mind who was a remarkably good example of this affection. He was unable to walk, and the muscular difficulty affected all the extremities. Obviously, when the patient was first seen, the chief difficulty was his inability to walk, or even to approximate a normal apposition of the soles of the feet to the floor. There was talipes equino-varus. With the apparatus for the treatment of this trouble, whatever its origin, I soon was enabled to place the patient's feet in such a position that I was satisfied that the weight of his body, instead of prolonging and aggravating the varus, would, at every step, be a powerful agent toward the reduction of the varus. The details of the treatment, which was painless, were very simple, but the result was extremely satisfactory. The varus and equinus were obstinate and of long standing. The patient was seven years of age. It was a congenital case. In a few weeks it was evident that these muscles were relaxing. In a few months the patient was able to plant the soles of his feet squarely upon the floor.

In the second year of treatment he was able to run about. There is almost complete relaxation of the muscles. There is no varus at all, even when the foot is not sustaining the weight of the body, and the effect upon his general condition is remarkable. A great deal depends upon education in these cases, the child being permitted to run about and exercise.

Dr. Ap Morgan Vance.—I would like to ask Dr. Judson if the spasm of the muscle returns when his patient is excited or irritated.

Dr. Judson.—It does not. He wears a brace all the time. Even when the brace is off there is no spasm, and there is just as much relaxation of the muscle and tendon as if he had been tenotomized. The result could not have been better. Of course, when the muscles have been thoroughly relaxed mechanically, the result is as permanent as after an operation.

Dr. Benjamin Lee, of Philadelphia.—I think that while massage, strictly so called, is not of special use in spastic paralysis, that which the essayist referred to as muscular education is often of very great use, and especially where the superior extremities are the seat of spastic contraction. I have found that rhythmical movements performed in connection with music or a metronome, or simply imitating the operator, the operator making certain movements at certain intervals, will often result in obtaining greater coördinating power.

There is one point which I think I have noticed in regard to the effect of tenotomy in such cases, and that is, that where there is mental imperfection associated with muscular contraction, and especially where there is excessive irritability of the emotional system—where children are inclined to fall into violent and uncontrollable passions and conditions of that sort—after tenotomy there will be a decided improvement both in the mental and emotional conditions. I have seen constantly recurring headaches of a violent character disappear entirely after tenotomy. There is no question that tenotomy does relieve these cases to a wonderful degree, but in the milder cases much may be accomplished by the use of muscular education and by the use of appliances which will maintain the limbs in their natural positions.

Dr. Robert W. Lovett, of Boston.—I would like to speak of one case which shows the advantage of an open incision over tenotomy. It was a case of contraction of the hamstring muscles in a patient fourteen years old. He had congenital spastic paralysis, and the knees were bent at an angle of forty-five degrees. The muscles were stiff, and did not relax under ether. I made an open incision, cut the hamstring muscle first, and found that I was unable to extend the leg at all, or very little more. I found contraction in

the fasciæ and ligaments of the joint, and I had to do a moderately careful dissection of the popliteal space, and divide everything on both sides before the legs could be extended.

Another complication in connection with this case was that the boy had incontinence of urine, but I did not know it at the time I operated on him. As a result of his uncleanly habits, in one knee-joint he had a suppurating wound. He came out all right.

There is a good deal of benefit to be derived from education of the muscular sense in these cases, as was shown by another case, which may serve as an example. A girl, with a moderately severe grade of spastic paralysis came from Vermont to have an operation done, as she walked very badly on account of congenital spastic paralysis. Being of good mental attainments, she was put through a course of muscular exercises. The feet were bent up daily, the legs stretched apart, and the patient was made to walk under the inspection of her mother, the effort being made to develop the abductor and extensor muscles. In the course of three years she has improved so much that the question of operation is deferred, and may not come up at all.

Dr. Bradford.—I am very glad Dr. Sayre called attention to the fact that I slighted the use of massage and electricity in these cases. I wished to accentuate the idea that electricity and massage, in severe contractions, are likely to be of great benefit. Muscular training is often of great benefit.

In regard to circumcision, I am glad also to hear what he says. It expresses what we ought to know in regard to the advantage of tracing some of the conditions to genital irritation. A large number of the cases which I have seen had already been circumcised. At one time, through a misunderstanding of Dr. Sayre's teachings, it was a prevalent idea that all cases should be circumcised. All the cases that came to me had been circumcised; I was relieved of that necessity; and the cases I have seen since have not had any genital irritation. If I understand Dr. Sayre correctly, he does not think that circumcision is advisable, except when definite indications are present.

In regard to the mechanical treatment, one case of severe spastic paralysis was treated as Dr. Judson has mentioned, by utilizing the

weight of the body. The patient was treated for two years or more. The result was successful, but it was not so satisfactory as in the cases where operation was done.

I would like to lay special stress on the advantage of open incision over tenotomy or subcutaneous incision in these cases, as referred to by Dr. Lovett. Where you have severe contraction at the knee and at the groin, I think it is absolutely impossible to do justice to your patient by means of a tenotomy; and nowadays, with asepsis, an open incision is perfectly safe, and you can operate with great precision and definiteness.

Dr. Gillette.—In answer to Dr. Sayre, who referred to the position of the foot as not being typical in the photograph, I would say that it is an exaggerated position of the foot, from the weight being thrown upon it.

AMPUTATION AS AN ORTHOPEDIC MEASURE.

By AP MORGAN VANCE, M.D.,
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The introduction of amputation as an orthopedic measure is out of the recognized lines of treatment, but as we are expected to relieve our patients of crippling and deformity, it is obvious that if amputation in some cases is the best, and often the only way this can be done, the operation may become orthopedic.

Even the most conservative among us occasionally meet cases in which the question at once arises, Would this patient be better off without this deformed foot or subluxated tibia? But few of us have ever removed a useless limb in order to substitute a useful artificial one. In the past ten years I have had under my care a number of cases in which there was no doubt in my mind that amputation, performed only for convenience, was better than any other treatment. Possibly some will say, You should refer such cases to the general surgeon. But I think that the mechanical and special training of the orthopedist peculiarly fits him to deal with these patients. Who should be better able to determine the proper method to be used or the point of selection in given cases—the general surgeon or the orthopedist? The orthopedist, of course, for he should know all about the mechanism of the prothetic apparatus. The general surgeon learns how to do the operation by a given method, but rarely knows whether an artificial leg is made of cork, wood, or what not, or when doing an amputation, bears in mind the subsequent comfortable and useful adjustment of the prothetic apparatus. He rarely knows that it is absolutely necessary to have from four to six inches space above the ankle-joint, and consequently we often meet men struggling through life with stumps, the result of amputation just above or through the joint. The same may be said of the knee. An

amputation through this joint is an abomination to the artificial-leg maker and a never-ending trial to the patient.

At least three inches space above should be left for the proper adjustment of the apparatus. We daily meet cripples who would be rendered more comely, comfortable, and useful by means of an amputation and the fitting of artificial limbs. Particularly is this true of cases in which the knee can be saved, although the condition of some may be greatly improved by a thigh-amputation. Among those in which the knee can be saved will be found a few cases of old infantile paralysis (talipes), and adult cases of congenital talipes, in which painful bursæ have developed, and life often rendered unendurable from the pain caused by walking.

On the other hand, old subluxated knees, with ankylosed patellæ, with flail-joints and great shortening, are not uncommon. I have known several of these cases that were converted from hopeless cripples into useful members of society by a proper amputation and the adjustment of an artificial limb.

The orthopedist is very frequently called upon to improve the condition resulting from the recognized, though barbarous, amputations through the tarsus, the only remedy for which is an amputation above the ankle-joint and an artificial limb.

The reason for these suggestions will be very apparent after an inspection of a modern artificial limb.

I will briefly report a few cases illustrative of the good done by amputation performed orthopedically.

Case I.—A. F., aged twenty-one years, single, called on me for advice in regard to an extreme deformity of the feet. He was very tall and thin, and gave me the following history: His family was phthisical. His feet were perfect up to eight years of age, when they gradually began to turn outward. He can give no explanation of this except that a tendency toward the position was produced by a pair of boots which were too short for him, and turned over at the heels, thus putting the structures on the inner side of the ankle-joint on a strain. There was no paralysis, or any disease of the bones. Efforts had been made to arrest the progress of the deformity, but they were of no avail.[1]

[1] Casts of the feet were shown to members of the Association.

The patient was six feet and four inches high, as he stood on the ends of the tibiæ, and I estimated that at least four inches were lost by the deformity. There was ugly ulceration of the parts which were pressed upon in walking. I advised for his relief a double amputation below the knees, and the application of two artificial limbs.

Both of the amputations were done at the same time, May 28, 1887, by the method of antero-posterior flaps with circular incisions of the muscles. There was no mishap during his convalescence, and July 20th, just seven weeks after the amputations, he walked out of the manufacturer's shop on two Bligh legs, assisted with only a stick, the first patient in the experience of the maker who had ever done this, even when only one artificial limb was required. The patient has gradually improved in walking, and when I last saw him, a year ago, he told me he had walked four and a half miles in an hour and twenty minutes, on a country road.

The method by which this man walked on his deformed feet being similar to that employed while walking on artificial limbs enabled him to manage the latter with greater ease than is usual. In adjusting the artificial limbs his height was reduced to five feet eleven and one-half inches.

After his convalescence he became a theological student at Hanover, Indiana, and now has charge of a church in Southern California.

Case II.—W. M., aged sixteen years, the subject of chronic hip-disease, with recent pathological dislocation.

After a subperiosteal excision of the upper end of the femur it was discovered that the whole of the femoral shaft was the subject of osteomyelitis.

Amputation was done forty-eight hours subsequently by the following method: The bone having already been removed, subperiosteally, sufficiently far down to allow the application of the Esmarch bandage, so that the tourniquet would come above the bone, the amputation was proceeded with by the mixed method—skin flaps antero-posteriorly, and circular incision of the muscles. No sawing of the bone was required, as the circular division of the muscles corresponded with the upper end of the bone so nearly that the limb

slipped away without any difficulty. The boy gradually recovered, and reproduction of bone occurred in the stump, the whole of the periosteum being left in a tolerably fair condition.

This amputation, necessitated by force of circumstances, suggests this method as a practical one in all cases where disarticulation at the hip is necessary, as it permits of the application of the Esmarch bandage and a bloodless operation. When the case was last examined two years and a half had passed since the amputation. Bone had been reproduced down to the end of the periosteum, and the joint is controlled by the muscles as if the original bone had never been removed. I have seen him walk on a limb in the rough, or an unfinished limb, with no more difficulty than is ordinarily exhibited by a patient when first trying to use an artificial limb.

Case III.—Miss M. T., aged eighteen years, had an inflammation of the left knee at the age of three years. Upon examination there were found five inches of actual shortening and great atrophy of the limb. The shortening was due to subluxation of the tibia, and arrested development. She was unable to use the limb without the aid of a long splint extending to the hip and perineum, besides a five-inch patten. By the aid of these she could get about with great difficulty, and suffered from many painful exacerbations of the inflammation, due to falls.

Amputation above the knee was advised, and was performed July 17, 1884. Within three months she had a Bligh limb adjusted, and since then she has been able to walk with comparative ease, and in comeliness and comfort is greatly improved.

Case IV.—C. W., aged twenty-four years, single, gave the following history: When about six years of age he received a blow upon the right knee, which was followed by acute inflammation of the joint, the limb rapidly becoming flexed. Various surgeons treated him, and many attempts were made to straighten and keep straight the limb. In the course of time an abscess formed, from which pieces of bone were removed. For the last ten years or more he had walked by the aid of a crutch with a stirrup upon it.

On examining the patient I found his limb flexed to an angle of about ninety degrees, perfect bony ankylosis having taken place. It

was much atrophied, although the muscles between the pelvis and thigh were well developed. The femur was bowed anteriorly from the great force thrown upon it while walking, the leg below acting as a lever.

The patient wanted his limb straightened, and after discussing the various procedures to bring about this result, we decided on the removal of a wedge-shaped piece of bone, including in the wedge the patella and part of the condyles of the femur and tibia—Buck's modification of Barton's operation.

On September 27, 1882, the operation was performed: the limb was straightened by force until the bony surfaces were in apposition. In order to accomplish this it was necessary to divide both hamstrings. He took chloroform badly, which required the operation to be performed much more rapidly than it would otherwise have been done, but no untoward symptoms followed after he was put to bed.

The patient was able to be about on crutches at the end of three weeks. In five weeks all dressings were removed, and the union was found to be bony. The external wound also had healed. There were two and three-fourths inches actual shortening.

This patient, in the eight years that have passed since the operation, has had no trouble, and walks well without a cane or crutch.

When this result was accomplished I felt that I had done a creditable piece of surgery; but in the light of subsequent experience I now feel that, in consideration of the greater danger of excision and of the stiff knee and high shoe, that I would have done this man a greater service by amputating above the knee. The patient's ability to get the best artificial limb would decide in favor of the latter. Other cases might be instanced, but these are sufficient to illustrate the fact that amputation is often an orthopedic measure.

DISCUSSION.

Dr. Reginald H. Sayre, of New York.—I heartily agree with what Dr. Vance has said, and I recall two patients in my brother's practice where amputation was done in preference to excision of the knee; in fact, the limb was so atrophied and would have required such a high shoe, that he thought the patient would be better with an artificial leg than with a stiff exsected knee. I had one case where I am confident the patient would have been better off if I had done an amputation instead of an excision. The patient, however, preferred to have her own leg left on. I think the risks would have been less, if I had amputated. I found a large cavity in the tibia and femur, and I had to leave a blood-clot in this space as large as an egg, to become ossified later on; this has given no trouble so far, but I think she would have been much more comfortable had the leg been removed.

In regard to these cases of hip-joint excisions wearing artificial legs: I amputated a hip two years ago; it was a case of osteomyelitis. I applied an artificial leg to the patient, there being a sufficient stump left. The amputation was done in a similar manner to that described by Dr. Vance, except that no periosteum was left. I have not seen the patient for a long time. He went abroad a short time after the leg was applied, but I understand that he has since returned to this country. I have not seen him, but am told that he cannot get around so quickly with the artificial leg as he can with a pair of crutches, the amount of leverage-power being insufficient for him to walk rapidly and swing his leg, and hence he has returned to crutches. I feared this might be the case at the time of the operation, though the first time he tried the artificial leg he seemed to walk well on it.

In cases where it is practicable to leave a large amount of periosteum—sufficient to generate new bone and make a good lever for an artificial leg—it would seem to me doubtful whether an amputation were preferable to a very extensive removal of bone, because if the bone were reproduced by periosteum to a sufficient extent for the leverage to be good enough to move an artificial leg with ease, I should think that the healthy part of the bone-shaft below that might

be preferable to an artificial leg. The largest amount of bone I have seen removed in a hip-joint excision was nine inches of the femur, by Dr. Spencer, of Watertown, New York. In that case there was a good deal of shortening, and, from a cosmetic point of view, the man would look much better with an artificial leg than with his own. But, in regard to its actual use, I rather think that he has more comfort in life now than if he had an artificial leg. Although there has been a large amount of regenerated bone, his leg is a good deal shorter than the other, but he has good motion in his hip-joint and is strong and athletic.

As for the man with twisted feet, I fear it would take many osteotomies to put that man in a comfortable position to walk, and if it were my case, I think I would cut off his foot.

Dr. Arthur J. Gillette, of St. Paul, Minnesota.—I am sorry I cannot criticise the doctor's paper. I thought, while he was reading his paper and before I noticed the cast, that there might be a chance for excision, but now I don't think so.

Amputation has always been regarded by some physicians and surgeons as the opprobrium of surgery—an acknowledgment of failure. But I heartily agree with what the doctor has said regarding amputation, and believe it is often an orthopedic measure. I am sure we try to save limbs by excision when amputation would be better. The patient would not be exposed to so much danger, and the ultimate result would be much better. Indeed, it is seldom we see an artificial limb applied, where an amputation has been done below or above the knee, that we can detect when the patient is walking on the street. Sometimes you will notice a slight limp. Even in a person with an excised ankle-joint, you can detect a little limp. Then, too, in cases where we resort to operation there have been long-continued suffering and suppuration of the joint, and the patients are in a bad condition constitutionally, and it is sometimes surprising to notice how quickly they rally after an amputation, and what a much better chance it gives them for a useful limb by the addition of some mechanical appliance. In a good many tubercular joints of the knee, ankle, and even hip, I think it is far better than to attempt to save the limb, because we do not get away all of the diseased tissue, and when we do we have an ankylosed limb. I have

had a little experience in this line in the way of operating on tubercular knees. I have always found it difficult to remove all of the diseased tissues, and I have removed considerable healthy bone and soft tissues. There is more or less trouble following the operation, and oftentimes suppuration follows and I have been obliged to resort to amputation. When we remove a portion of the limb the way we do, we make it shorter; we immobilize the joint; the patient has to go through all the risks of shock following the operation, and there is always more or less shock where there is considerable diseased bone and tissue to be removed. I believe, with Dr. Vance, that amputation with the application of an artificial limb under these circumstances would be much better than an excision.

Dr. A. B. Judson, of New York.—I see no reason why amputation should not be performed in such cases as have been described, and I would not hesitate to agree to it any more than I would to the removal of a digit in a case of hammer-toe, which often causes great inconvenience and pain to the patient. But I could not help thinking, while the paper was being read, that most of the patients who require operative measures reach their unfortunate condition from neglect of orthopedic surgery, and, with that idea in my mind, I am more enthusiastic than ever before in regard to orthopedic surgery as a specialty.

Dr. E. H. Bradford, of Boston.—In regard to the case of amputation of the hip-joint, I think I understood Dr. Vance to say that the child walked around quite well with an artificial leg.

Dr. Vance.—Yes, sir. The patient was sixteen years old when amputation was performed.

Dr. Bradford.—I had a similar experience in a child eight or ten years of age, where I had to amputate the hip-joint for hip disease, and where new bone had formed at the stump with motion of the hip. I had to consider the question of an artificial leg, and was in some doubt as to whether the patient would be able to handle the leg well. I asked the question, to know whether experience would encourage the use of an artificial leg in a boy of that age.

Dr. Vance.—I put them on in boys seven years of age. Some patients are expert with the crutches, and will not take the trouble

to learn to walk with an artificial limb. This boy did not have the limb finished. They always try them on in an unfinished condition first.

Dr. John Ridlon, of New York.—There is no question in my mind regarding the propriety of amputation in some of these cases of tubercular disease. If the disease is sufficiently serious to require the operation of excision, it is serious enough to require amputation; and if the child is strong enough to recover from an excision, it will recover under proper mechanical treatment without an excision. In young children I feel that excision is unjustifiable in very many cases. We should either treat the case without an operation or do an amputation. In children after amputation, where growth and the expense of replacing artificial limbs have to be considered, a very satisfactory limb can be constructed for a small expense—from five to eight dollars—by utilizing the Thomas knee-splint. This splint makes a leg that is comfortable to the patient, steady and firm, does not compress the part in any way, and can be replaced without any material expense.

Dr. George W. Ryan, of Cincinnati.—I am entirely in accord with most of what Dr. Vance has said, particularly with reference to diseases of the knee- and ankle-joints. I am not so sure about the hip-joint.

I have the case of a little girl under my care at present in which excision was done by another surgeon some years ago. There is a flail joint as the result of it. I think the result would have been better had amputation been performed.

Another case in point—a patient who had extreme paralytic calcaneo-valgus, and who had worn an apparatus ever since he was four years of age, without any great improvement. The physician that attended him came to my office and asked what could be done for him. I told him that, perhaps, the best thing to do would be to cut his foot off. He seemed surprised that a member of this Association should advocate such a measure.

I think Dr. Vance makes a mistake in calling it an "orthopedic measure." It is simply a criticism in the way of a name. I believe, in many of the cases where the disease is extreme, that amputation is far better than excision.

The application of an artificial leg is something that we, as orthopedic surgeons, should consider more than we do. Dr. Judson remarked that, if these cases were seen and treated in the beginning, we would not have to consider the question of amputation. That is true, of course; and when we have educated our patients and the profession to believe it, we shall not often have to consider the question of amputation in our practice.

Dr. Judson.—Viewing the subject from an etymological standpoint, the operations which have been described are not strictly orthopedic—a term which is applicable to the practice of one who leads a patient to grow or become straight. Strictly speaking, it is not orthopedic to straighten by cutting, breaking, or crushing, and still less to amputate. While all these procedures may, on occasion, be a part of orthopedic practice, it is a question for each individual whether he will perform operations himself. The relation between orthopedic and operative surgeons ought to be, and doubtless is, such that a patient who needs the special services of both will not fail to obtain the desired relief.

Dr. Bradford.—This quibbling of terms brings up something we may as well face as surgeons. We do not want to look at details so much as we do at our patients. I do not think any of us would hesitate, if it would benefit our patients, to administer drugs. If a patient needs cod-liver oil, we would prescribe it, and, for the time, we would cease to be orthopedic surgeons and become therapeutists. We would not think of asking for or calling in a professor of materia medica if cod-liver oil were indicated. The question is, What shall we do with our patients? We want to do the best thing for a hip-joint or other disease that can be done. We take a case from the beginning; even if neglected, we take it and do the best we can with it. We see more cases than falls to the lot of the general surgeon. It is not a difficult matter to amputate; it is not difficult to one who is trained to do antiseptic surgery, We ought to know better than the general surgeon knows when amputation is necessary in hip disease or disease of the knee-joint. We know such cases as we have saved, and we should be able to save more than a general surgeon can.

Dr. Judson.—I agree thoroughly with the idea that the surgeon should be devoted to the interests of his patients, but we owe something to the general profession. A word in regard to the relation which exists between the general practitioner and the orthopedic surgeon. One of the latter who limits his practice to his specialty, ought, it seems to me, to limit his ambition also to the treatment of such cases as the family physician refers to him. The multiplication of specialties is but a division of labor; and it seems to involve, furthermore, a question of the survival of the fittest—a question into which enter, among other things, the preferences indicated by the public, and the inevitable occurrence in general practice of a number of more or less intractable cases, the responsibility of which can be better borne by the specialist.

In my view, the pure specialist occupies a comparatively humble position. He is limited in the range of his studies and interests, and is called in only in an emergency—a necessary evil, so to speak. He has his reward, however, in the thought that he is an authority, although his domain is small, and in the further thought that some few sufferers obtain relief which would be unattainable except for his self-imposed limitations.

Dr. De Forest Willard, of Philadelphia.—I only desire to emphasize what I said this morning. I am anxious to have the American orthopedic surgeon take as high a stand as possible, and not to be satisfied with a low position. I do not think we have any right to adopt a low standard. As I have previously said, we should be thorough surgeons in the first place, and then we should add to this knowledge the careful special study of the gain to be accomplished by the application of mechanical appliances. We know that we give our cases greater care, study, and attention than does the general surgeon.

It seems to me a disgrace to orthopedic surgery that a case should be carried to a certain point and then sent to a general hospital, when the orthopedic surgeon himself ought to be competent to complete the case. The true orthopedic surgeon should be ready to treat, care for, and carry a case through all its stages, no matter whether the treatment requires the application of apparatus or whether it necessitates a serious surgical operation.

Dr. A. J. Steele, of St. Louis.—I find the members of our Association divided into two classes. Some are largely, almost entirely, mechanical in their treatment; others enter largely the field of general surgery, doing cutting and other operations when demanded. I enlist myself with the latter class. The orthopedist should first be a general surgeon. He should practise general medicine and surgery for ten years before he takes up a specialty like ours, and then he ought not to go into it unless he is somewhat of a mechanic. Shall we not open abscesses? If so, may we not go further and do what is best to be done, and all that can be done, for the cases that come under our care?

At the Washington meeting I reported two cases of excision of the knee-joint. One of the patients, a boy, now plays ball and is very active. He wears a patten. The other case was a girl, eighteen years of age, with knee ankylosed at a right-angle as a result of neglected synovitis. She wrote me a short time ago from Texas, saying she was married, happy, and well, and had so disciplined herself as to walk with hardly a perceptible limp. She wears a patten about three or four inches, and showers blessings upon my head for what I did for her. I was criticised because I did not amputate instead of excising in these cases. These patients prefer their own limbs, though with stiff knees, to artificial ones. I do not know whether the gentlemen would say, Never excise a limb, or not; but, if so, I think they are wrong. Amputation has its place as a last resort only.

Dr. Bradford.—I think Dr. Judson hardly did justice to himself or to the position of orthopedic surgery. If I understand him correctly, it is this: Orthopedic surgery requires a great deal of attention to mechanical detail, and we should confine ourselves to that. We hardly do justice to ourselves by simply taking this view of it.

Dr. Judson.—While I admit that our position is humble in the ranks of scientific attainment and achievement, I am of the opinion that our work as pure specialists calls for technical knowledge, sound judgment, and skilful manipulation in a greater degree than any other branch of surgery.

Dr. Vance.—I fully expected to have such a discussion come up, particularly with our orthopedists who do not operate, who do not do much bone-breaking, laminectomy, etc.

In answer to Dr. Sayre, the same idea about the reproduction of bone crossed my mind. The cartilages of the knee were diseased, however, and the lower epiphysis was a mass of tubercular osteitis; it would not have been good surgery to scoop out the whole medullary canal and remove the lower end of the femur.

In reply to Dr. Judson, let us take, for example, one of his cases of calcaneus, where he has, in order to get locomotion with any comfort, to inflict a steel brace, with a chance of modifying nutrition; and, as the patient grows older, the power is not as great, and the circulation is less active. A patient can walk further, dance, and climb a ladder much better with an artificial limb. He cannot do this with ordinary apparatus.

I have seen cases where it was no easy matter to tell which was the leg amputated. If the operation of amputation for the relief of these conditions greatly benefits our patients and brings about a correction of the trouble and furthers the future usefulness of the limb, I believe it is the thing to do. It would be foolish to refer them to a general surgeon. I claim we are the ones that should know best what apparatus to use.

I know in my experience that amputation done through the ankle-joint is barbarous in the extreme. The same is true of the old-fashioned tarsal amputations. They should be obsolete. Amputations through the knee-joint are more dangerous than those done above. The adjustment of an artificial limb is better accomplished to a stump than is the result of the latter operation.

With reference to what Dr. Steele said, I do not claim that excisions ought not to be done. I do them all the time. If the amount of shortening is going to be too great, a man should be left to choose between amputation and excision.

Dr. Ryan criticised the nomenclature. The word "orthopedic" has been considerably changed in its meaning. Orthopedics, the world over, covers the ground of breaking legs, excising knee-joints, taking off spinous processes, etc. I think the word, in its true meaning, means to prevent or correct deformity and relieve crippling.

I cannot agree with Dr. Ridlon that the Thomas knee-splint will

give as much comfort and usefulness as an artificial limb. It acts in the same way as bearing on the perineum, but with flexion at the knee. The comfort of an artificial limb, I think, would be superior to the Thomas splint, even in children.

I agree with Dr. Bradford that it is the duty of the orthopedist to do any operation that will bring about the best result. I am afraid we, who do general surgery, are liable to get our cases a little mixed. I am a general surgeon, and do anything that comes along, unless I think some one else can do better. That is the reason, probably, why the term "orthopedic" has widened of recent years.

A READY METHOD FOR COUNTER-EXTENSION AT THE KNEE.

By HENRY LING TAYLOR, M.D.,
NEW YORK CITY.

If the knee-joint is, from its position and structure, peculiarly liable to acute and chronic inflammations, it is also favorably situated for examination and treatment. Experience has shown, however, the obstinate and serious nature of many cases of synovitis and arthritis of the knee, and the frequency of grave sequelæ, unless treated with the utmost care and precision.

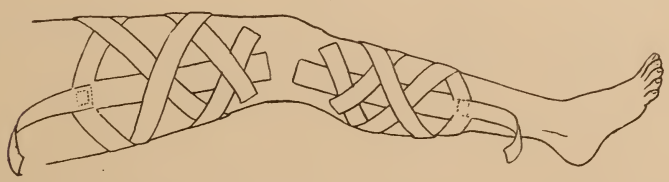
We endeavor to put the parts at rest and to prevent friction by immobilizing the joint in the more or less flexed position instinctively assumed by the patient, and to abolish harmful pressure on the surfaces by counter-extension in the lines of the tibia and femur.

Properly-applied counter-extension with fixation and recumbency usually affords prompt and often marvellous relief to the intense suffering in the active stage of the trouble, and at the same time provides conditions favorable to the proper nutrition of the joint and the subsidence of the inflammatory process. I have seen a young man who had been in such agony for months from a synovitis of the knee that narcotics were freely administered with only slight mitigation, breathe a sigh of relief the moment the straps of the counter-extension splint were tightened, and remain free from suffering from that time, with coincident subsidence of the inflammation. Fixation alone or simple traction by means of the weight and pulley, however useful in an emergency, give by no means the same results, and I am convinced that the early application of some form of counter-extension is of extreme importance in surgical inflammations of the knee-joint. My object is to indicate one or two ways in which counter-traction may be effectively applied with-

out elaborate apparatus, remembering always that, in mechanical as well as operative surgery, the success of any procedure depends strictly upon the care and skill of the operator, and that no amount of theoretical acquirement will compensate for the lack of exact and dextrous manipulation of details.

The patient being put to bed, the first step in the dressing is the application of adhesive plasters to each side of the leg and thigh. To get a firm and even grasp of the limb, I use a three-tailed or five-tailed plaster made as follows: Four pieces of yellow adhesive plaster, about an inch and a half wide and eight inches long for an adult, have firmly sewed to one end a piece of webbing six inches long, and two strips of rubber plaster three-quarters of an inch wide and about twenty inches long, in such a manner that the webbing prolongs the yellow plaster, while the strips of rubber plaster make with it an angle of sixty degrees, as shown in the cut (Fig. 1). We

Fig. 1.



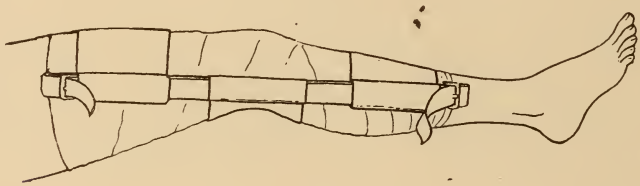
now have four three-tailed plasters with webbing attached.[1] Two of these are applied to the leg below the knee, one to each side, the webbing starting about four inches above the ankle, and falling toward it; the narrow strips of rubber plaster are wound spirally around the leg slanting toward the knee. The two remaining three-tailed plasters are similarly applied to the thigh, the webbing starting a few inches below the level of the crotch and falling toward the pelvis (Fig. 1). When in place the plaster is retained by a light bandage. It is thus seen that when the four ends of the webbing are doubled on themselves and buckled over the edge of some form of fixation-splint reaching beyond the plaster in both directions, that traction is exerted on the knee, both above and below.

It is necessary to apply the plasters to the leg and fasten the

[1] If we wish to use strong traction we may use five-tailed plasters by sewing another pair of rubber plaster strips just above the first.

webbing to the splint in such a manner that no prying or twisting force is exerted upon the knee, or pressure will be increased instead of relieved. The splint must be rigid to provide fixed points for the traction, and must immobilize the knee laterally and antero-posteriorly, without pressing upon the joint. If flexion is moderate, two straight strips of wood, like laths or window-shade sticks, cut the proper length and provided with buckles near each end, will do very well. The strips are well padded with cotton or folds of fabric above and below the knee and at the ends, and securely fastened in place on each side of the limb by bandaging them together over the top of the thigh, behind the knee, and above the ankle; after this additional bandages may secure the whole. We now have to draw the pieces of webbing over the end of the side splints as tightly as we wish, and fasten them into the buckles provided (Fig. 2). Our

Fig. 2.



simple counter-extension splint is now complete, but it is usually desirable to attach five or six pounds to the lower end of the apparatus by the ordinary cord, pulley, and stirrup arrangement, the knee being carefully propped and supported in the flexed position by hard cushions or in a sling. If much flexion is present, a tracing of the leg should be taken on paper, and wooden side splints with a corresponding angle, and, perhaps, hollowed at the knee, can be prepared by the carpenter. This dressing[1] has worked well and given prompt relief in a number of cases, but it occurred to the writer last summer that the ordinary plaster-of-Paris splint, reaching from above the ankle to near the crotch, might be utilized for the same purpose and prove more convenient in an ambulatory case. I have used such an arrangement with satisfaction in a number of cases, of which one was a bad old case of osteitis of the knee with

[1] Used by Dr. C. Fayette Taylor since 1871.

nearly ninety degrees of flexion, for whom I was preparing and have since applied a more perfect steel splint. The plasters were applied to the limb as before, bandaged in place, and the knee covered with cotton; over this was placed a light plaster-of-Paris splint with strong edges, over which small pieces of cardboard were bent where the webbing was reflected. Buckles attached to bits of webbing were bandaged into the plaster on the outer and inner side of the limb at each end, and to these the plaster webbing was fastened (Fig. 3).

If the patient is small, a stiff tin or zinc posterior splint could be bent to correspond to the angle or flexion and turned up at the sides for lateral support and to receive the buckles near the ends.

Fig. 3.

Whatever the form of apparatus we use for fixation and as a fixed point for our counter-traction, it is essential that no leverage—especially no prying or twisting force—is exerted upon the joint. If the counter-traction acts in the lines of the deformity, we should in most cases speedily get relief from pain, diminution of tenderness, heat and swelling, relaxation of the flexor muscles, and an improved general condition of the patient. As the mechanical conditions are favorable, the amount of traction need not be great, not nearly so great as is required at the hip, but it should be constant and in the proper direction. Even in our steel splints ratchet-traction is not required, as merely drawing the straps into the buckles by the hand gives a sufficient pull. After a few days or weeks motion will be freer; as the muscles relax the splint is straightened, and counter-extension in the improved position continued. The later stages toward recovery may present indications for different management, and the ultimate result will depend upon an exact apprehension of the physiological requirements of the joint at each stage, and precision in meeting their demands.

DISCUSSION.

Dr. Reginald H. Sayre, of New York.—I think Dr. Taylor's device is a very efficient and very useful means of quickly putting a patient's joint in a condition of comfort while suffering pain. I think it is an excellent plan. The method of attaching adhesive plasters to the skin and reversing the ends over a wooden splint is the same that was introduced by Dr. Swinburne years ago for keeping fractured bones in position. He applied a lot of sticking plasters to the leg, letting the tails run in any position they happened to take, then reversing the two ends of the plaster over wooden laths applied on each side of the limb, and, bringing them firmly together, tied them at such a position as to keep the fragments in position. The little bandage which Dr. Taylor puts on in the popliteal space, or a little below, to form a nice cradle for the head of the tibia to rest in, to prevent posterior luxation, would give the patient a greal deal of ease in a very easily adjusted manner. I think that for a quick method of putting the patients generally in a good position to avoid the subsequent deformities which take place, it is an excellent means. The attaching of the same sort of appliance to plaster-of-Paris or a metal splint is also a good way of effecting the same result.

My father has been in the habit of taking a splint that was moulded to the leg, and lining it with sticking-plaster, adhesive side out; then making traction with his hands on the leg, and, while the leg was so held, the splint was adjusted to it, the object being the same which Dr. Taylor gets by means of sticking-plaster on the leg first, and then pulling the two ends around the splint. I think that Dr. Taylor's method is easier of application.

It seems to me that the great thing in the knee-joint cases is to get traction first of all in the long axis of the shin, and, secondly, to get a little traction at right-angles to this from behind forward, to prevent the deformity which occurs from the contraction of the ham-string muscles and the gastrocnemius, and when applied in these two directions traction will prevent deformity from taking place; and, unless the case is too far advanced and too firm adhesions have taken

place, it will correct such deformity as has already taken place in the joint through neglect.

Dr. Robert W. Lovett, of Boston.—The question must present itself to all those who have these patients to treat, how extremely difficult it is to treat cases where there is flexion in knee-joint disease with any inexpensive apparatus. The apparatus shown by Dr. Taylor would seem to meet the indications. The same end can be accomplished by having a long traction-splint, jointed at the knee, with a perineal band. The splint can be set at any angle, and the joint protected at the same time while the patient goes about. But such splints are expensive, and to apply traction to a knee even a little flexed with a Thomas splint is likely to start up an acute inflammatory condition. So that there would seem to be a field for such appliances as these of Dr. Taylor in patients who are not able to buy more expensive apparatus.

With regard to the sedative effect of plaster-of-Paris bandages in this condition: if applied to the leg in its flexed position, in the course of a week the muscular spasm relaxes, so that at subsequent visits the leg can be straightened until it becomes perfectly straight. When the leg is straight, the Thomas knee-splint affords a very efficient mode of treatment.

Dr. John Ridlon, of New York.—This splint of Dr. Taylor's seems to me to be very deficient. It lacks both fixation and traction. About all the fixation it gives is gained from the traction, and traction obtained from adhesive plaster applied in this way is of no use as a traction force, and only effectual because of the splinting which it gives the joint by drawing tense the skin. Effectual traction can be obtained only by going to some bony point above, as is obtained by the Thomas splint. This splint, with its padded ring resting beneath the tuberosity of the ischium, if extended some inches below the foot can, if adhesive plasters be applied from the knee downward, be made the most effective traction splint of which I have any knowledge. The same effect which Dr. Taylor seeks in using the sling of bandage at the back of the knee is gained much more effectually by the broad strip of leather stretched between the rigid iron side-bars of the Thomas splint. When the leg has been straightened

the Thomas splint is cut off, attached to the shoe, and becomes a purely fixative and supporting splint.

Dr. E. H. Bradford, of Boston.—I understand that Dr. Taylor uses the splint chiefly in the acute cases of synovitis, and that this bandage below is not designed especially to drive the tibia forward, but to fix the leg so that traction can be made in the line of deformity. The suggestion is a useful one, and the splint is an efficient one.

I would say one word in regard to the Thomas splint which Drs. Ridlon and Lovett have been discussing. I have found the same difficulty Dr. Lovett speaks of, although I have found the benefit that Dr. Ridlon speaks of from its use. I have had the pleasure of seeing Mr. Thomas apply it in both acute and chronic cases. In some cases I have used it, and I have sometimes thought I made the knee temporarily more sensitive from its use; and in other cases I have found it extremely useful and efficient where traction is applied. It is the old question of the artist who was told to mix his colors with brains. I think that if any one has seen Mr. Thomas apply the Thomas knee-splint—and I have no doubt it is also the case with Dr. Ridlon—they will notice greater skill in its application than I am conscious of being able to use in many cases.

Dr. A. J. Steele, of St. Louis.—I believe the idea of reducing intra-articular knee-pressure by means of sticking-plaster placed on the thigh above and on the leg below, is a myth. The ends of the plaster are not far apart, so the separative force is expended on the integument. It is the bones that we desire to seize and pull apart. By the time the force, which is applied to the skin and acts indirectly upon the cellular tissue, fat, muscles, etc., reaches the bone, it is lost.

The apparatus shown is admirable as an immobilizing apparatus. If I were going to make traction I should prefer the method of using the Thomas splint, where the extension might be on the leg below the knee and counter-extension at the tuberosity of the ischium.

My own practice in these knee cases is to put on a plaster-of-Paris splint, and change it every little while, if necessary. If not, I keep it on two or three weeks. When the acute symptoms have

subsided, I substitute a sole-leather splint made over a cast of the part. This immobilizes the joint and supports the part, and, with patten and crutches, no weight is borne on the knee. I am much pleased with the results thus obtained.

Dr. L. A. Weigel, of Rochester, N. Y.—I fully endorse the remarks made by Dr. Steele and Dr. Lovett on the efficiency of plaster-of-Paris as an immobilizing agent and for securing rest.

It is generally admitted that all appliances in which the lever principle is used are objectionable. In the acute cases we can certainly do harm with them; yet I believe in some cases, where the acute symptoms have subsided and where the deformity is purely muscular, a lever apparatus, judiciously employed, may be of advantage in overcoming or correcting a certain degree of malposition. I have used an apparatus in which elastic webbing, attached to two levers below the joint, is employed for traction. When it is desired to intermit traction on account of pain, or for other reasons, the amount of correction can be maintained by means of a set-screw at the knee-joint. By releasing the screw and tightening the webbing, gradual correction can again be gone on with.

Dr. A. B. Judson, of New York.—It seems to me that it is hard to estimate the amount of traction which can be made by the admirable apparatus which Dr. Taylor has shown us. It is difficult to demonstrate the amount of traction any apparatus makes. I can hardly suppose, however, that enough traction can be made in this way to resist the action of the circumarticular muscles. It is reasonable, however, to think that by this method enough traction can be made to fix the joint; and we must admit, from what Dr. Taylor has reported, that enough is made to give comfort and remove pain.

Dr. Weigel.—I would like to ask whether relief from pain in these cases is due to traction or fixation, or both?

Dr. Sayre.—Although foreign to the question, I would like to say that, so far as my experience goes, traction plays a large *rôle* in giving freedom from pain in these joint cases. I find this in applying my father's knee-splint, which acts on the same principle as Dr. Taylor's. Although the leg is fixed, yet by extending the bars and

making traction you can make it very comfortable or uncomfortable for the patient. If you make too much or too little traction, he suffers pain. If you stop just at the right point, he is free from pain, though the leg is immobilized in both positions. The joint does not joggle inside the bandages and bar. There is more or less pull through the skin to the subjacent parts. I do not suppose the amount of pull you get drags the joint-surfaces apart so that there is a flapping about, but there is enough traction exercised to make a vast difference in the patient's sensation, and a minute difference will cause him to be comfortable or uncomfortable, and this I do not believe is due to the immobilization of the knee.

Dr. F. H. Milliken, of Philadelphia —I would like to ask Dr. Sayre whether he believes that a greater amount of traction would cause more pain than a small amount, because it seems to me that the traction is not exercised so much on the ligaments as on the muscles that regulate pressure.

Dr. Sayre.—This question of traction is an interesting one. You observe the same thing in a spinal case. If you make traction on the head and shoulders in a case of Pott's disease, in almost all acute cases you will find a certain point where the patient is free from pain. He will say he is uncomfortable if pulled more, and uncomfortable if pulled less. Between certain points there is no pain, and my object is to keep him at that particular point until the disease gets well. The same way with a disease of any joint. If I put the joint in a position where it is free from pain and keep it there, my experience has been that the case goes on to recovery; and I suppose the spasmodic twitchings of the muscles are due to violence done to the inflamed joint, and by making traction of sufficient force to overcome the muscular spasm we put the joint where it is free from this violence, and, hence, in the best position for nature to restore it to as good condition as may be.

Dr. Taylor.—Of course, the question of extension and fixation opens up a wide field for discussion, into which I do not now care to enter. I believe that there is such a thing as extension, and that it is useful when properly applied; and that, in the use of this apparatus, both extension and fixation do good. I would not go so

far as to recommend extension without fixation in acute joint diseases, but I do recommend counter-extension in addition to fixation.

This device which you have seen is merely one for an emergency; but I think, if properly manipulated, that it might be used for some time with advantage. You can use it to make a patient comfortable, and to put him on the right road. It must be used, as Dr. Bradford has well said, with brains, in order to produce the proper effect. The best splint will not work itself. It is like a shovel—you have got to have a good, strong Irishman behind it to accomplish anything.

TREATMENT OF INFANTILE CLUB-FOOT PRELIMINARY TO OPERATION.

By F. H. MILLIKEN, M.D.,
PHILADELPHIA.

The purpose of this paper is to offer some suggestions regarding the treatment to be used in cases of club-foot before proceeding with the final operations of tenotomy and osteotomy. Not infrequently we hear of tenotomy, and even of osteotomy, being performed on the feet of infants not more than two or three months old. This is premature practice, and is attended with disadvantages which result from the fact that the muscles of the feet are not yet being used in walking.

In a congenital, or an early acquired case of talipes, the bones, tendons, and ligaments are distorted and displaced, and although tenotomy may be performed, and the feet twisted into their normal position, yet as the members do not assume their proper functions until the child walks, it must remain for many months an open question whether a further resort to the knife may not be necessary. Although success is attained by careful surgeons who personally supervise the subsequent manipulative and mechanical treatment in these cases, it cannot be denied that relapses are more frequent among very young infants than among older ones who have received surgical assistance at about the time they began to use their feet and legs.

The fact that a relapsed case of talipes is always difficult to correct, should make us hesitate to perform a cutting operation until other and simpler means have been tried; but when resort to the knife is the only alternative, the best time to operate is at the age when the child would begin its efforts to walk. Although it is considered advisable to postpone cutting operations until near the time

when a healthy child would begin to walk, yet other means should not be neglected, and, if possible, the child should be helped to use its limbs properly without any operation.

Happily, malformation of the limbs of the infant is readily recognized at birth, and no time need be lost in using such means as the surgeon may decide on as most suitable to the case, preliminary to the probable final resort—tenotomy.

At birth the tissues are soft and yielding, and with slight manual force can be helped into their proper places. A case of slight talipes can be relieved by daily manipulation, while the same case, if left to itself for several months, will establish a tendency to permanent malformation of the limb; the bones, tendons, ligaments, and fasciæ all becoming more adapted to persistence and permanence in their abnormal conditions. Owing to this condition, the machinery of the limb being thrown out of gear, the natural coöperative action of the different mechanical parts being turned aside, permanent lameness and deformity are established.

Perhaps no better means could be suggested for correcting a case of infantile talipes than holding the child's foot in the correct position by the hand of nurse or mother until a cure could be accomplished. But, as in the nature of things, this would be impracticable, the next best course must be adopted. The nurse must be *instructed* to manipulate the part ten or twenty times a day, bringing it into a correct, or as nearly as possible correct position. Emphasis is upon the word *instructed.* It will not do to let the nurse merely see the surgeon manipulate the foot and then imitate the procedure as best she can. The surgeon must see that she understands how to grasp the child's foot, and that she knows in what direction to apply the force. A nurse lacking intelligence enough to understand exactly what the surgeon directs her to do is worse than useless, as illustrated by the following case:

A child under my care suffered from equino-varus with incurvation of the toes. The nurse was instructed to grasp the heel and ankle firmly with her left hand, and the anterior portion of the foot with her right hand. She was shown how to correct the incurvation, and by continuing the force bring the foot into a condition of valgus, if possible. In endeavoring to carry out the instructions, the woman

grasped the child's leg above the ankle, took hold of the foot, and gave it a wrench that bade fair to rupture the deltoid ligament.

In addition to manipulating the foot, the muscles that control it should not be neglected. Massage and the faradic current should be employed, and here, also, the surgeon must be vigilant to see that his directions have been faithfully carried out. Simple instructions to *rub* and *knead* certain parts are likely to be neglected, but if a liniment is ordered with which to do the rubbing, the nurse or mother believing that the curative virtue lies in it will use the liniment. By noticing its diminution from day to day the surgeon learns whether the rubbing is attended to in his absence.

Very little dependence can be placed on mothers to aid us in correcting the deformed feet of their children. The child's cries excite sympathy, and the manipulations are either abandoned, or are so slightly performed as to be of little practical value. In view of this fact mechanical means must be employed to stretch the contracted tissues, and, after stretching, to retain the foot in the corrected position. Perhaps the simplest and most efficient appliance for this purpose is a plaster-of-Paris bandage. In the dispensary of the University of Pennsylvania nothing has given so much satisfaction, among infants under one year, as the following method of treatment:

First, we stretch to the utmost tension consistent with safety the contracted tissues which are holding the foot in malposition. This is effected by a succession of efforts, using a sufficient amount of force to draw and adjust the parts to the desired position, and then easing off the strain, and repeating it again and again. A continuous or sustained tension would probably injure the tissues, and prove less efficient.

The tolerance of the feet to the application of force is remarkable. I have frequently felt the tissues tear, and have heard them snap under my hands during my efforts to correct a deformity. This tolerance is most apparent in cases of obstinate and relapsed talipes, in which it is necessary to use powerful levers and wrenches to accomplish the desired result.

After correcting the deformity as far as possible, by stretching and adjusting the parts, prominent points should be protected by a

padding of cotton, over which a flannel roller should be smoothly applied. Care should be taken to avoid creases and reverses in applying the flannel bandage, otherwise troublesome sloughs are likely to follow, necessitating an abandonment of the treatment for a time, or the substitution of another dressing. The same caution is applicable in making the first turns of the plaster bandage.

In applying the plaster bandage the turns should be made with a view of correcting the deformity by making traction on the roller, *e. g.*, in a case of equino-varus, the bandage should begin at the outer ankle, run diagonally across the top of the foot to the ball of the great toe, thence under the sole to the little toe, and then with a long sweep to the middle third of the leg. This can be repeated until the entire leg and a portion of the thigh are covered in. The knee should be bent, otherwise the child is liable to kick the bandage off. The greatest care should be exercised to hold the foot in a correct position while the plaster is setting. It should not be grasped by the hand, as the pressure of the fingers leaves indentations in the soft plaster, and these, when dry, are liable to cause sloughs by pressure on the delicate skin. The palm of the hand should be applied to the sole of the foot, and pressure should be made in a direction opposite to that of the deformity.

Hahn recommends a method by which the foot may be held in a corrected position while the plaster is setting. One or two layers of plaster are first applied, when the cross-piece of a T-shaped board is placed on the sole of the foot, the ends extending beyond the heel and the toes The upright of the T projects on the side of the foot. Several turns of bandage are then made to cover and secure the board. A powerful lever is thus obtained. When the plaster has sufficiently hardened, the projecting ends of the T may be removed by means of a saw. I have never used this method, but it seems an efficient one.

Bradford and Lovett in their excellent work recommend that the plaster dressings be renewed every two or three weeks. This, I do not think is often enough. Once a week, or every ten days, gives the surgeon more work, but better results. When the dressing is removed it is advisable to wash the limb with soap and water, and then rub it vigorously with alcohol, or better still, with hamamelis. Before re-incasing the foot in plaster the deformity must be still

further reduced, and this treatment should be practised at each subsequent dressing. A decided improvement in the position of the foot will soon be apparent if the manipulations are properly performed, and more especially if the surgeon be not too timid to use the proper amount of force to bring the parts into their normal position.

The plaster-of-Paris dressing has been almost universally described as cumbersome, awkward, and unsightly. The criticism is just if the foot is encased in roll after roll of the plaster, but this is not necessary. My own practice is to use a bandage one and a half inches wide. Three, or at most four, layers for the foot, and three for the leg, are sufficient to hold the most obstinate foot in a corrected position. Over this a woollen legging or a stocking may be drawn. The toes should be exposed, thus enabling the mother to note any change in their appearance. If they become cold, or blue, the dressing should be removed at once, but this will not happen if the plaster be properly applied.

The plaster dressing is preferable to apparatus that corrects the deformity by means of straps, for the reason that the pressure is made on the entire foot, whereas in the Scarpa shoe, and in others made on the same general principle, traction is confined almost entirely to straps. These are liable to cause excoriations at the points of contact with the skin, necessitating the removal of the apparatus. Valuable time is thus lost. The only disadvantages in the use of plaster are that electricity, massage, and friction cannot be also employed. This objection applies, as a rule, to acquired talipes only. It has an advantage, however, possessed by no other appliance—that of not being tampered with or removed by the parents of the child.

Elastic traction is employed in cases of club-foot to aid the weaker muscles, and as a constant force tending to pull the deformed members into place. The well-known apparatus of Barwell may be used, but is objectionable in that the urine of the child is liable to soak the dressing. The same principle is carried out by Sayre's shoe, which consists of an ordinary laced shoe, except that the shank is replaced by a ball-and-socket joint. This leaves the front of the shoe free to be acted upon by force. Two steel uprights extend from the heel to the upper third of the leg. An elastic strap is attached to

the sole of the shoe, and extends to a button which is riveted to one or other of the uprights near the knee.

Dr. Willard has introduced a shoe that is equally efficient and less expensive. Instead of a ball-and-socket joint, the shank consists of a piece of thin sole-leather, or of soft upper leather, thus obtaining free movement in every direction. The brace used with this shoe is an improvement on the simple uprights. Greater leverage is obtained by means of a steel arm which is riveted to the stirrup of the uprights. This arm extends forward, upward, and outward, and is pierced at its free end with an eye. Through this eye runs a catgut cord, fastened below to the sole of the shoe, opposite the head of the metatarsal bone, and above to a piece of elastic webbing. The apparatus is especially useful in cases of varus with incurvation. Another very simple and most efficient apparatus, also introduced by Dr. Willard, consists of two pieces of printer's blanket, an elastic band, and two ordinary shoestrings. The printer's blanket should be from two to three inches in width, and of sufficient length to encircle the foot, and the leg above the calf. The ends of the blanket are pierced with eyes, or lace hooks may be substituted, and the two pieces are laced to the foot and leg with the gum side next the skin. The elastic band is then fastened to the laces and stretched between the two pieces of blanket. The strength of the bands should be adapted to the requirements of the case. The advantages possessed by this simple dressing are, that owing to the adhesive property of the gum it does not readily slip, and need not be so tightly laced as to interfere with the circulation of the blood. It does not absorb urine or feces, nor cause excoriation of the skin, and can be frequently washed without injury. Best of all, it permits manipulation and the use of electricity without disturbing the dressing. An ordinary shoe can be put on over this dressing, thus concealing it, a point which many mothers appreciate.

In private practice, and among people possessing a fair amount of intelligence, the traction principle is by far the best method of treating infantile club-foot; but in dispensary practice we meet with a different class. Here the directions are not faithfully attended to, and the cases often show little improvement. For this reason the fixed dressing is preferable for dispensary cases.

But neither the fixed dressing nor any other can be entirely de-

pended upon to correct a case of severe club-foot, or effect a permanent cure, without a final resort to the knife. What is here advocated is preliminary treatment only. When the child shows an inclination to walk the proper time has come to perform tenotomy, and then the advantages of the previous treatment will be apparent. The plantar fascia will not require such extensive division; the divided ends of the tendons will not separate so widely, and the deformity can be reduced with comparatively slight force. Besides, when ordinary care is bestowed, there is no fear of a relapse, and the child will be equipped with a more efficient foot than it would have possessed had tenotomy been resorted to earlier.

DISCUSSION.

Dr. A. J. Steele, of St. Louis.—I would like to ask Dr. Milliken if he carries the plaster-of-Paris above the knee. If he does not, the child would be apt to kick it off.

Dr. Milliken.—Yes; I think it is a good plan. The entire leg and a portion of the thigh are to be covered in. The greatest care should be exercised to hold the foot in a correct position while the plaster is setting.

Dr. Steele.—I have adopted a similar plan to that recommended. It was suggested to me by my preceptor, Dr. E. M. Moore. He taught me to bind a piece of thin board, about the shape of the sole, on to the foot, and then the board could be used as a lever to move the foot with. The wetting of the plaster splint by the infant is disagreeable; I cover it with shellac and thus prevent it. To soften the plaster, that it may the more readily be cut for removal, I formerly used nitro-muriatic acid, but now find that vinegar answers every purpose. That, or acetic acid, so softens the plaster that with a jack-knife I get on much better than with a saw. I have tried various shears for cutting the plaster, but a little vinegar and a knife answer the purpose better.

After straightening the foot pretty well, sole-leather splints may be bound on to keep the foot in place. Different sizes of leather

splints, made over casts of normal feet, may be had, and of different degrees of straightness, turning the foot in the opposite direction, if necessary.

Dr. L. A. Weigel, of Rochester, N. Y.—While the discussion is on the removal of plaster bandages, I would like to say a few words. Some time ago, an article appeared in one of the medical journals suggesting the incorporation of fine steel wire between every one or two layers of bandage while being applied, turning over the ends and leaving them in place. When the time comes for removing the dressing, the layers of bandage are ripped open by these wires. I do not remember, just now, the gentleman who proposed this method. I have not tried it.

The method of incorporating a wooden sole in the bandage for correcting the foot, which Dr. Steele spoke of, has been improved upon by Hahn, who uses a T-shaped piece of wood.

Rose has also proposed widening the sole of an ordinary shoe by means of U-shaped pieces of steel attached to, and projecting from, its outer border. These act as levers during walking, and tend to lift the foot out of its varus position.

Dr. Ap Morgan Vance, of Louisville, Ky.—I have treated a good many cases of infantile club-foot in the last ten or twelve years. In the treatment of these cases we have no disease to deal with, and usually they have good feet.

The point which we are asked to talk about is the time to commence treatment. Personally, I commence to treat these cases about the tenth day. In the first place, we must overcome the varus. I convert the foot, during the first six weeks, into an equino-valgus. There are several ways of doing this. I place the foot in a plaster-of-Paris cylinder, and leave it for a month; or use a gutta-percha splint well padded, and re-apply often, gaining something each time.

In overcoming the equinus, I have not had the satisfaction with plaster-of-Paris as with a modified Scarpa's shoe, for the reason that in fat infants, unless you can flex the knee at right angles, the fat foot will tease out. If you dig a hole at the bottom of the heel, after ten or fifteen minutes you will find that the foot does not approximate the dressing.

I do not agree with Dr. Milliken in regard to the time when tenotomy should be performed in these cases. I see no reason why the operation should not be done after the child is two months old. This is certainly long enough to wait. I formerly tenotomized at six months, but now I do it at two months. The older cases I have treated in the same way, overcoming the varus by force and applying a long splint to hold it there; I then tenotomize the tendo-Achillis and convert the foot into calcaneus.

Dr. A. B. Judson, of New York.—A useful material for the correction of varus before the child begins to walk is found in sheet-brass, which comes in all thicknesses and may be readily cut in any shape and hammered to fit the irregularities of the part. A splint thus made, when protected from oxidation by gum plaster and suitably covered with canton-flannel or silk, may be applied with strips of plaster. As the foot improves in shape the splint may be altered to correspond with the improvement made. It should be applied on the inner side of the foot and leg, with its convexity directed outward, and by degrees this convexity of the splint is to be reduced and changed to a concavity, the ankle at the same time being drawn toward the splint until the varus is reduced to valgus. This point should be reached before the child walks, and, after that, the foot should be held by a simple brace in such a manner that the weight of the child at every foot-fall shall be a force acting against the varus, and in this way the patient should be kept under observation and intermittent treatment till the skeleton has its growth.

Dr. George W. Ryan, of Cincinnati.—As regards the time when tenotomy should be done, I am in accord with the author of the paper. There was a time when some of us believed that the sooner it was done the better.

In the first place, there is practically only one way to cure deformity. We can cure the equinus easily enough at any time, but the varus is the stumbling-block which troubles us. The tight heel-cord is of benefit in correcting the varus, and there need be no hurry in dividing it.

Concerning the application of plaster-of-Paris, I was surprised to hear one gentleman say that he put on cotton first to cover the joint,

and then plaster-of-Paris carried above the knee, so that the child will not kick it off. There is reason for carrying a bandage above the knee. I put plaster over the skin; sometimes I put a little layer of cotton over the malleoli. If I get beginning osteitis of the knee-joint with any deformity, I believe that in that way I can get complete fixation. If I use a cotton bandage I do not get fixation. In the older cases I carry the plaster up to the crotch. I want to correct, in a measure, the tendency of inversion of the foot, which is the troublesome part of the after-treatment. The plaster treatment has been a very satisfactory one with me in dispensary practice. The small amount of padding which I use in the dressing—often none at all—I believe is of great aid in securing the absolute fixation desirable and thereby preventing the "teasing" of the muscles and the resulting pressure over the ball of the great toe.

Dr. Reginald H. Sayre, of New York.—In regard to the time for cutting these tendons, in the first place I believe in beginning the treatment at birth. I think that there are two classes of tendons —those you can, and these you cannot, stretch. When you can differentiate between the one and the other, you save yourselves much time and trouble.

Many years ago my father concluded that such tendons and structures as (when put on a stretch) yielded a spasm on being violently pinched or pressed upon by the point of the finger, could not be further elongated, and must be cut or torn. As far as my experience goes, such tendons as have yielded this spasm have been incapable of further stretching. This is a question which Dr. Ridlon brought up some time ago, and asked the section of the New York Academy of Medicine to decide. Dr. Ridlon never brought his cases around to decide upon, and the question still remains as it was then. I think that if you get a tendon which gives spasm after stretching and pinching it, you may as well cut it at once. It will not stretch any further. If, on pinching, it does not yield spasm, it is capable of further elongation and can be stretched still more.

Dr. Vance.—At what age would you cut these tendons?

Dr. Sayre.—I would cut them whenever I got spasms. I want to say that in a good many cases where I have manipulated them

with my hands, I have ruptured a good many tendons, ligaments, etc., and the foot has come around to a perfect position with only a moderate amount of violence. Sometimes in handling them we unconsciously burst them. I would not let the age of the child stand in the way of operation if the tissues yielded a spasm.

Dr. Henry Ling Taylor, of New York.—We must distinguish between cases we see in private practice and those we see in dispensary practice, and plaster may have some advantages in the latter. If one understands the principles of treatment, they can be successfully carried out with plaster or with metallic or other splints. The results will depend largely upon the appreciation and exact application of correct mechanical principles by the operator. Those who have had experience in treating these cases mechanically will postpone operations later and later. I never hesitate to operate when I see any real reason for it, yet I find my tenotomies are quite rare.

As one of the speakers has remarked, and as I pointed out in a paper last year, the principal thing is to cure the varus. We want to swing the foot outward by means of some form of lever, and get it thoroughly into the valgus position; then you can either stretch the gastrocnemius, or tenotomize, and bring the foot up quickly. In either case the foot must be held in correct position for a considerable time afterward.

Dr. Vance.—Do you think tenotomies injure the muscle?

Dr. Taylor.—That question cannot be satisfactorily answered with a simple yes or no; I think they sometimes do.

Dr. Milliken.—I wish to thank Dr. Steele for his suggestion as to the use of vinegar in removing plaster dressings. It is, of course, simply an acid acting on an alkali.

Drs. Steele and Taylor speak of the use of leather and metallic splints. My objections to these splints are that they are not as easy of application, and cannot be as accurately moulded to the foot as plaster. In using the former appliances the foot must of necessity, to save it from pressure, be swathed in thick layers of cotton, thus giving it a certain lee-way after the splint is applied. The foot cannot, therefore, be held in its corrected position with the same accuracy

as by the use of the latter dressing. In addition, as I took occasion to mention in my paper, metallic, leather, and other dressings are readily interfered with by parents, an objection that I think will be readily admitted is not applicable to gypsum.

Dr. Vance believes in doing nothing for cases of infantile club-foot until the tenth day. He then corrects the deformity by manual pressure, incases it in plaster, and allows the dressing to remain for a month or six weeks. If the foot is not then in good position, he performs tenotomy. Nothing is gained by waiting for a certain time after birth before commencing treatment; but, on the contrary, something is lost. During this waiting period, as stated before, the contracted muscles and tendons become more contracted, the stretched ligaments and the distorted bones become more confirmed in their faulty positions, and the foot is altogether in a worse condition than it was at birth. I do not agree with Dr. Vance in allowing the foot to remain in plaster for a month or six weeks without renewal. Any advantage that may be gained by the use of plaster will have been attained in a week or ten days. By holding a foot so long in a fixed dressing, we make a club-foot rather than unmake it.

Dr. Vance states that he would rather use the shoe that Dr. Willard brought from abroad. This is simply a modification of Scarpa's shoe. Scarpa's shoe, and all its modifications, are open to objections. By their use we attempt to correct a deformity by making pressure with straps, not on the entire foot, but on a limited portion of it. While these appliances go far toward correcting a varus, they would, perhaps, so press upon a baby's foot as to cause excoriations. It would then be necessary to abandon the treatment until the foot was again in condition to bear pressure. Much valuable time would thereby be lost.

Dr. Ryan agrees with me in carrying the plaster above the knee. I do not follow this practice as an absolute rule, but only in cases where the child's legs are fat. In these cases, if the gypsum dressing is not carried so high, the child will very likely kick the dressing off—at least, such has been my experience.

As to the use of cotton padding, Dr. Ryan has misunderstood me. When I stated that the prominent points of the foot should be covered, I did not mean that a thick wad of cotton should be applied. If such were the case, Dr. Ryan's criticism would hold good. A

thin layer—just sufficient to take off the direct pressure of the plaster—is applied.

As to the advisability of performing the cutting operation in the early months of life, I have already spoken at length. I should like, however, to emphasize one point. If early tenotomy is decided on, the tendo-Achillis should be the last tendon cut. If it is sacrificed before the varus is corrected, we lose a powerful lever, by means of which the tarsal bones could have been twisted into their proper places.

As regards the contractured tendons of which Dr. Sayre has spoken, I must confess that in infants of three or four months I have never found one.

SACRO-ILIAC DISEASE.

By BENJAMIN LEE, A.M., M.D., Ph.D.,
PHILADELPHIA.

Inflammation of the sacro-iliac synchondrosis is, in my experience, the rarest of the affections to which the spinal system is liable. Writers speak of it as of quite common occurrence. Sayre, in his great work on *Orthopedic Surgery*, mentions having frequently met it in children. I have never seen a case except in the adult. The only anatomical feature to which I would call attention in prefacing my remarks is the fact that only one-half of the articulation is provided with cartilage, and that the inner or anterior half, viewing the joint vertically. In the large majority of adults this cartilage partakes of the character of the intervertebral disks, gradually becoming of a pulpy consistence as it recedes from the bone and approaches the middle of the interspace. In rare cases a synovial membrane is found, and during the distention of the pelvis in pregnancy this is said to be sometimes temporarily provided. This peculiarity of conformation has, I believe, an influence on the sequence of the symptoms of the disease under consideration to which I will make later allusion. Not detaining you with a general description of the affection, I proceed at once to present the histories of two cases which have led me to bring the subject to your notice.

History.—Mrs. W. B., aged fifty-one years, married, mother of several children; first seen March 27, 1890.

About thirteen years ago, the patient fell heavily upon the ice, while walking in the street, striking the buttocks and back of the head. Her weight at the time was one hundred and eighty-five pounds. Her health had always been perfectly good. She remained

unconscious for fully half an hour after the fall, having been carried into the nearest house. She was then taken home in a rocking-chair, and was quite unable to walk the remainder of the day or the day following. Gradually, however, the effects of the injury seemed to pass off, and for five or six years she suffered no serious inconvenience from it. She was then attacked with severe pain in the right iliac region anteriorly, which confined her to bed for ten days. The family physician pronounced it peritonitis, but she feels certain that she was without fever during the entire period. From this time every unusual exertion or excessive fatigue induced a recurrence of this pain, often confining her to bed for several days. In the course of a year from the first attack, her dressmaker called her attention to the fact that the right shoulder was lower than the left. This condition of things lasted about three years, when the abdominal pains began slowly to diminish, while, at the same time, she became aware of pain in the back, low down, principally on the right side and in the sciatic nerve, running down to the foot and accompanied by a sensation of pricking and numbness. This was pronounced, two years ago, to be sciatica, and was heroically treated with iodide of potash and colchicum. This treatment giving no relief, antifebrin was tried, also in very large doses. The only result was great enfeeblement of the heart, impaired circulation, loss of appetite, and general prostration. The excruciating pain continued unabated, and her health seemed utterly broken down. At the end of another year her husband called in a specialist in nervous diseases. This gentleman disagreed with the family physician in the matter of diagnosis, declaring that the seat of the disease was not the sciatic nerve, but the spine, and demonstrated the existence of a spinal curvature. He proposed to treat it with electricity. Ten weeks of his care, however, brought no amelioration. In despair an irregular practitioner was now consulted. He confirmed the diagnosis of spinal curvature, but, after a few visits, was honest enough to tell her that the case was beyond his skill. The family physician was now again sent for and informed of the opinion that had been given as to the nature of the affection. This he combated with some warmth, but finally consented to examine the spine for the first time. He had no sooner exposed the back than he exclaimed: "Why, this is not a case for a physician—it's a case for a mechanic!" Ob-

serve the refinement of the expression—"a case for a mechanic." He undoubtedly knew of a dozen physicians who made the mechanical treatment of spinal curvatures their study, but he preferred the mechanic. Accordingly, to a mechanic she was sent, and in the latter part of August, 1889, was fitted with a well-adjusted rawhide jacket, by a surgical instrument maker. Little by little, she began to improve, until soon the pain entirely ceased, she became able to walk with ease, and for a period of four months enjoyed an entire respite from the excruciating agony of the past several years, and considered herself a well woman. Then, little by little, the pain in the back returned, she began to limp again, and the sciatic nerve again became the seat of intense agony.

The instrument-maker believed that she had lost flesh and the jacket had thus ceased to support her. She had manifestly become much straighter. Accordingly, a new jacket was made from a fresh cast. To her utter disappointment this jacket entirely failed to afford relief. It was altered in various ways, but to no purpose; and, at last, utterly worn out with suffering, and almost without hope, she consulted me. I had but to see her standing with the back bared, to arrive at a diagnosis. The curve of sacro-iliac disease is unlike any other curve. It is a curve without compensation. Her entire trunk was displaced from the pelvis toward the left, so that a plummet let fall from the seventh cervical vertebra would probably have touched a point from three to four inches outside of the cleft of the nates. There was no rotation whatever. A slight line of hardened tissue could be felt along the sacro-iliac junction, and pressure upon this line caused pain. Usually with a lumbar curve to the left we have a dorsal curve to the right, and the right shoulder is elevated. In her case the left shoulder was the high shoulder. Her gait was peculiar—something of a limp and something of a stagger. This peculiarity of gait her friends noticed before she herself became sensible of any very severe pain. It was accompanied with a curious swing of the body. As to the general condition, her pulse was very feeble and frequent, her color pallid and ashen, and her countenance haggard: her nights were restless, and her appetite gone.

The explanation of the apparently inexplicable facts that the first jacket afforded for so long a time absolute relief, while the second

was absolutely useless, no matter how tight it was worn, was now to my mind quite clear. The "mechanic," as ignorant as the family physician of the nature and seat of the disease which he was called upon to treat, had, by a happy accident, carried the jacket so low down and adjusted it so accurately around the hips that he had put a splint upon the pelvis. Motion through the inflamed joint was prevented, and irritation of the sciatic nerve at once ceased. In making his second jacket, he had failed to bring it so low or adjust the lower portion so carefully, and the necessary support was not afforded. Pleased with the wonderful improvement which had taken place in the curvature, and especially in the position of the shoulders, his attention was rather fixed on the upper part of the spine, and to improvement there he devoted his greatest care. My own mode of treating these cases had always been to encircle the pelvis with a stout band, making as strong compression as the patient could bear, and adding support to the spine if occasion seemed to call for it.

I had, however, not chanced to see a case for some time, and thought it advisable to consult standard authorities. To my astonishment, I found that they agreed in recommending extension as the only rational treatment. Desirous to give my patient every possible advantage, I put her at once to bed and applied extension with weight and pulley, although with some misgivings. The good effects of complete rest and removal of the weight of the body from the painful joint were at once noticeable in increased appetite and improved color. But the tenderness of the sciatic nerve appeared to increase. It became painful under pressure for a distance of several inches down the thigh. Several attempts were made to have the original jacket so altered as to be serviceable, but without success. A strong elastic hip-band afforded a certain degree of comfort. At the end of three weeks, examining her in the erect posture, I was startled to find that the deformity had been greatly increased by the use of extension. The pain also returned in all its pristine vigor. I now therefore felt myself justified in abandoning the use of extension, and applied an instrument similar to the one which I show you, which I had been having made for her. It is, as you see, simply a spinal splint with lateral crutches, and a partially stiff, broad, hip-band. The hip-band, however, is made adjustable both at the front and the back, and, buckling in both places, is capable of making

great compression. The spinal portion of the apparatus is principally of use in keeping the hip-band in its proper position, low down on the hips, although it may secondarily be of service in restoring the trunk to its erectness. So long, however, as the sensitive condition of the joint remains, all attempts to correct the curvature will be simply worse than useless.

The application of this instrument was at once followed by amelioration of all the symptoms, although not so rapid or complete as that afforded by the first jacket, partly, as I considered, because the disease had in the interval made greater progress. With ordinary care, the patient now enjoys life once more, and is able to attend to many household duties with entire freedom from pain. The sciatic nerve is still somewhat sensitive to pressure, and she cannot take long walks without suffering, but I feel warranted in looking for complete recovery.

The following case is also interesting and instructive:

History.—Miss H. W., twenty-four years of age, came to my office January 29, 1890; large and well developed, inclining to obesity; by profession a music-teacher.

A prominent feature in her case was pain in the right iliac fossa, accompanied by excessive nervous excitement. The treatment which had been employed in its earlier stages was that for inflammation of the ovary, including almost every means that has ever been suggested. From this region the pain extended down the leg of the same side as far as the knee. All of the usual remedies for sciatica were also tried, but without benefit.

The symptoms finally became so much aggravated that removal of the right ovary was suggested as a last resort, and she was spayed *secundum artem.* The operation was skilfully performed, and her recovery was uninterrupted. A friend, who was in the room during the operation, assured her that there was no tumor, but the ovary was diseased. It is my intention to communicate with the surgeon and find out what the diseased condition was. Whatever it may have been, it was not the cause of the pain, inasmuch as that continued with little alteration, and she now came to me for relief. She was wearing a light, thickly padded spinal corset, which, to a con-

siderable degree, masked her deformity. When this was removed, I was astonished to see the extent of the distortion. The right hip was thoroughly uncovered and the left concealed, and the seventh cervical vertebra much to the left of the line of the cleft of the nates. She was never without pain when in the erect posture, and walking often caused great agony. She limped, her gait was unsteady, and accompanied by a swaying motion of the body. Being dependent upon her own exertions for support, she naturally felt great anxiety lest she should be compelled to give up her lessons altogether.

As expense was a matter of some moment to the patient, I utilized the corset which she already had, reinforcing the flimsy splints in the back and adding a lateral spring. Independently of this, I applied a stout leather band about the hips, as low as possible without interfering with locomotion. This was held in place by perineal straps. Owing to the nature of her avocation, she is compelled to maintain the upright posture all day, and to be much on her feet. Notwithstanding this fact, she has improved steadily since the hips were splinted. The pain has greatly diminished and the distortion is noticeably lessened.

From these two cases I would deduce the following corollaries, on which I invite discussion:

1. Disease of the sacro-iliac symphysis induces a characteristic deformity of the spine, of which the features are a lateral displacement of the entire trunk in a direction away from the affected side, a single curve comprising the entire length of the spine, and the almost invariable absence of rotation.

2. It also induces a peculiar rolling or waddling gait.

3. It is often the cause of inveterate and excruciating sciatica.

4. It is useless to attempt to remedy the spinal distortion so long as its cause remains unrelieved.

5. The existence of chronic pain in the sciatic nerve, not yielding in a reasonable space of time to medication, should always lead the practitioner to make a careful examination of the spine and of the region of the ilio-sacral juncture.

6. This affection is met with more frequently in adult than in child life.

7. Its appropriate treatment consists in splinting the pelvis, and thus preventing motion between the opposing surfaces of the symphysis, motion not being its natural function.

8. For the same reason, extension cannot be expected to produce the favorable results in this affection that we obtain from it in diarthrodial joints.

9. The disease is often of extremely slow development.

10. Its first symptom is often abdominal pain, whence it may readily be mistaken for peritonitis, ovaritis, cystitis, and the like.

11. This pain is principally referred to the side on which the lesion exists, but may gradually extend to the opposite side.

12. The existence of severe unilateral abdominal pain, accompanied by little or no febrile action, should lead to the suspicion of the existence of this affection.

13. A mechanic may, by a happy chance, give temporary relief to a patient suffering from this disease; but as he is entirely ignorant of its seat and nature, he is not, perhaps, the safest person to refer the patient to.

DISCUSSION.

Dr. L. A. Weigel, of Rochester, N. Y.—Probably but few of us are able to discuss sacro-iliac disease from personal experience in its treatment, because it is one of the rare forms of trouble met with in orthopedic practice. We are prepared to admit that traumatism may be one of the exciting causes, and that in the majority of cases the disease is of a tuberculous nature, the same as affections of other joints. The diagnosis in the earlier stages is not so easy as that of disease in other joints, which are more accessible for examination and comparison. The process of exclusion is, perhaps, the best one to adopt in a suspected case. While some text-books give a series of symptoms as guides, it must be remembered that they are such as we find common to other affections, particularly sciatica. The characteristic curve spoken of differs from the ordinary rotary-lateral The curve is away from the side of the disease, the convexity being toward the sound side. I think this is readily explained by the fact

that when there is pain anywhere—*i. e.*, pain produced by contraction of any group of muscles—the patient instinctively endeavors to relax the muscles. For instance, in the disease under consideration the patient would naturally incline his body toward the affected side and relax the muscles attached to the pelvis, and in that way mechanically produce lateral curvature. It is purely a muscular curvature. I have seen cases of curvature of this kind due to lumbago, the patient persistently bending over to one side to relax the muscles.

With reference to the treatment, I am not prepared to discuss the plan the doctor has advocated. That fixation is one of the primary indications of the treatment, goes without saying. Anything that will put the joint at rest must necessarily give relief. It occurs to me, however, that circumferential compression of the pelvis alone would not be enough to give the relief desired, for the reason that the jar incident to walking is transmitted from the feet up to the pelvic bones, thus keeping up a constant irritation. A rational mode of treatment would consist of rest, secured either by recumbency or a combination of pelvic compression with the high shoe and crutch, as used in hip-disease.

Although I have had no personal experience in treatment of this disease, I have been able to get notes of an exceedingly interesting case, which was beyond question of a tubercular nature. The patient, a physician, thirty-four years of age, was taken, two or three years previous to his death, with severe hæmoptysis, from which he never fully recovered. He emaciated rapidly, and in about two months after the onset of the pulmonary hemorrhage he began to complain of pain in the left gluteal region, which was rather obscure in character. He was seen at this time by several of his associates, but no positive diagnosis was made. It was thought that it might be sciatica or some other nervous trouble. The pain did not yield to the ordinary remedies, and his condition steadily grew worse. He limped badly, and could only get about with the aid of crutches. He was unable to sit in any position with comfort. At this time there was no swelling or other sign of local disease about the pelvis. A diagnosis of sacro-iliac disease was made by one physician, and one of the principal points upon which it was based was the marked pain referred to the sacro-iliac region upon percussion of the ilium or

pubes. An abscess finally appeared in the left gluteal region, which was aspirated repeatedly. The patient died in April, 1885.

At the autopsy no evidence of intra-pelvic disease was found; upon opening a sinus in the left gluteal region, however, it was discovered that the sacro-iliac joint of that side was completely disorganized, the bones being eroded for a distance of about four inches.

Dr. Taylor, of New York.—I would like to ask Dr. Weigel whether, in the case reported, the characteristic deformity of which Dr. Lee spoke and the characteristic walk were present?

Dr. Weigel.—The characteristic walk was present, and I presume the distortion also; but, as I have been informed, the deformity was not specially noted, probably because it was not looked for, on account of the obscurity of the affection in its earlier stage.

Dr. Arthur J. Gillette, of St. Paul, Minn.—Do you not think, Dr. Lee, you would have gotten as good a result with simply a pelvic band? I do not see the use of the spinal appliance. The back was not weak or tender. The crutches did not support the weight of the body. I do not think that the relief was due to other than the pelvic band.

Dr. A. J. Steele, of St. Louis, Mo.—I would be inclined to adopt Dr. Weigel's suggestion, in addition to a pelvic band, take the weight of the body off the joint as much as possible, and so keep it quiet.

Dr. Lee.—With reference to the inquiry as to whether there is any occasion for a spinal portion to the apparatus, I mentioned in the paper that the special object of that portion was to keep the pelvic band accurately in position. I also attempted to keep it in position with perineal straps, but the result is not so satisfactory as where you have a spinal support, the weight of the body pressing upon and preventing the band from riding up. There is certainly some assistance derived from the spinal support in the gradual restoration of the body to its erect position.

As regards Dr. Steele's remark, he must bear in mind that there

is a distinction between a diarthrodial joint and a synchondrosis[1] In one case nature never intended that we should have motion; in the other, nature did intend that we should have motion. In one case we appropriately use extension; in the other we use fixation.

[1] This articulation might, perhaps, more properly be classed among the synarthrodial joints or even the sutures.

THE TREATMENT OF PERSISTENT ABDUCTION OF THE FOOT,

COMMONLY KNOWN AS CHRONIC SPRAIN OF THE ANKLE.

By ROYAL WHITMAN, M.D.,
NEW YORK.

The successful treatment of any chronic affection demands a personal, persistent attention to details on the part of the surgeon. This is particularly true of the treatment of what are known as minor injuries, and therefore neglected.

One of this class, to which I propose to call your attention, is commonly known as chronic sprain of the ankle, an affection which may entail years of discomfort and disability, with permanent impairment of the functions of the foot.

The usual history of such cases is as follows: Long-continued weakness and discomfort, following an injury to the ankle, treated by various physicians with liniments, blisters, and bandages until the discouraged patient is told that nothing more can be done, but that his symptoms "will wear away in time." A year or two later he presents himself, usually for the purpose of procuring a brace, or for some peculiar shoe which he thinks may be of service to him.

He complains principally of weakness, stiffness, and insecurity, of fatigue and pain in the foot and ankle on any over-exertion. He walks with a somewhat awkward gait, the foot everted to avoid flexion at the ankle, with a very noticeable limp when fatigued; in fact, he walks as little as possible. On examination, one finds that the foot is abducted—that is, turned outward in its relation to the leg—that forced adduction and extension are resisted and are very painful to the patient. There may be some swelling, often of the dorsum of the foot, or in front and below the external malleolus. In other cases the ankle appears perfectly normal. The arch is not

markedly diminished, but there is a prominence on the inner aspect of the foot, at the astragalo-scaphoid joint, caused by its abducted position. Thus, although in a well-marked case all the movements at the ankle and at the medio-tarsal joint are somewhat restricted, those of adduction and extension are almost lost, there being a spasmodic contraction of the peroneii and extensor longus digitorum, with shortening of ligaments and fascia on the outer side, varying according to the time the foot has been held in its improper position. The amount of abduction varies. In many cases there is simply a slight limitation of adduction and almost no spasm of muscles. In others, usually in young subjects, there is a tonic contraction of the abductors, raising the outer border of the foot and throwing it into a position of marked deformity, presenting the appearances of what is sometimes called spasmodic valgus.

In making the diagnosis of this condition, it is important, as a preliminary measure. to test the movements of the foot—(1) in relation to its fellow; (2) to the normal range of motion. This varies considerably with the age or personal peculiarity of the patient, but, according to a number of measurements, the average is about as follows:

Forced flexion, 70 to 80 degrees. Forced extension, 140 to 150 degrees.

Adduction is much more difficult to determine, but it may be said that a person sitting, holding the leg perpendicular to the floor, the foot being somewhat extended, should be able to raise its inner border until the sole forms an angle with the floor of about 60 to 40 degrees.

In this position the patient with persistent abduction of the foot is usually unable to raise the inner border at all.

I wish to call your attention particularly to the fact that a foot with persistently restricted motion in any direction, especially in that of adduction, is in no condition to recover under treatment by blisters, bandages, or rest, unaided by other means. Sprains of the character we are considering are usually caused by a fall from a height, or by the body turning outward over the foot, straining and rupturing the internal lateral ligaments, a more sudden violence producing in the same manner a Pott's fracture. Either as the direct result of the accident, or from the subsequent weakness of the

internal ligaments, a subluxation of the astragalus takes place downward and inward, while the remainder of the foot is thrown outward, so that a disturbance of the muscular equilibrium results. The adductors, working at a disadvantage, are unable to perform their functions, while the abductors, the peroneii, and extensor longus digitorum, in the effort to hold and steady the foot, are thrown into a state of spasmodic contraction, so that it is, as has been described, rigidly held in abduction, while the power of adduction is limited or lost.[1]

Abduction of the foot is the position of weakness; adduction, that of strength and activity.

In other words, the usefulness of the foot depends upon the preponderance of power of the adductor muscles. When this is lost, weakness and pain ensue. If this proposition is accepted, the treatment becomes simple:

1. To overcome the contraction and spasm of the abductors.
2. To strengthen the adductors.

This can best be accomplished as follows:

The patient being etherized, the affected foot is forcibly extended and adducted—that is, the heel and toes are both turned inward, so that the inner border of the foot is bent like a bow; it is then forced inward under the leg to a position of extreme equino-varus, the operation being attended with audible cracking of adhesions in all the disused articulations. In this position a well-fitting plaster bandage is applied, with the object of persistently over-stretching the shortened ligaments and contracted muscles and holding the foot firmly in its new position.

The pain after the operation is much less than might be supposed from the violence that is often necessary to accomplish the result.

The bandage may remain on a variable length of time, according to the subsequent pain and the difficulty that has been experienced in the reposition. From one to three weeks is the average. When it is removed, the foot, though in good position, is usually somewhat swollen, sensitive to pressure, and all its movements are limited and often painful. Now a course of massage is necessary,

[1] When, from any cause, movements of the ankle or medio-tarsal joints are painful, the patient everts the foot to avoid flexion in walking. In neglected sprains, this habitual faulty position may induce persistent abduction or even flat foot.

gentle at first, followed by bandaging and complete rest. In two or three days, when the swelling has subsided, the patient begins voluntary exercises, assisted by the surgeon, the attempt being made to place the foot in the position of adduction—that is, to regain the motion that was lost. Thus, the patient contracts the adductors and flexors, while the surgeon aids, by gently pressing at the same time on the dorsum of the foot. At the conclusion of the exercise the surgeon, holding the foot firmly, turns it slowly inward toward the position of equino-varus, and retains it there until the involuntary resistance diminishes. This movement is usually accompanied by a very painful sensation of stretching in the muscles and ligaments of the outer border of the foot, which gradually diminishes as the foot returns to its normal condition. This portion of the treatment, described by the patients as "twisting," is by far the most important. Patients strongly object to it at first, but afterward submit to it willingly, as it relieves the sensation of painful stiffness, while the gain in range of motion after each application is very evident. When the pain and stiffness have diminished, usually in from one to three weeks, the patient is allowed to use the foot.

As the foot was formerly everted in walking, he now walks with the toes directly in front of the body, so that the flexors and adductors must be exercised with every step. He is to wear a Waukenphast shoe, as its inward twist aids in holding the foot in proper position. If necessary, its inner border may be built up, after the method of Thomas. I invariably use the foot brace, which has already been shown the Society, to support the foot and prevent abduction until the patient by constant exercises and avoidance of improper positions has allowed the foot to return to its normal condition. These exercises are very simple:

1. The movements of adduction and extension which have been described.

2. Raising the body on the bare toes twenty to thirty times, morning and night, as recommended by Ellis.

3. And most important, a correct walk, by which the body must be raised upon the foot at every step, as described in Vol. I. of the *Orthopedic Transactions*.[1]

[1] Treatment of flat foot. Whitman.

The successful treatment of this class of cases may, I apprehend, be summed up as follows:

Discover what movements of the foot are restricted, with the apparent causes.

Then a persistent endeavor to overcome such restriction:

1. By forcible reposition to break up adhesions and to overstretch the contracted muscles and ligaments.

2. A long-continued massage intelligently applied by the surgeon. It is not sufficient to order rubbing of the foot—this has been done by the patient for months—but a manipulation diligently carried out with the purpose of stretching the shortened ligaments and overcoming the contraction and spasm of muscles.

3. A reëducation of the patient as to the proper positions and movements of the foot.

This course of treatment is often long, tedious, and painful, but it is, I believe, the only one which may restore the injured member to strength and usefulness, and if the patient and surgeon are not prepared to carry it out, it is better for both that the attempt should not be made.

Having spoken of the treatment of this affection, we may now consider how such a condition may be avoided.

The surgeon called upon to treat a recent injury to the ankle should remember that the subsequent disability is almost invariably the result of abduction, because the original injury is usually to the internal lateral ligament and those of the medio-tarsal joint.

Consequently, it seems reasonable, in a sprain of any severity, to place the foot for several days in a well-fitting plaster bandage in the position of adduction, to guard against a possible subluxation of the astragalus, and to relax the injured ligaments and muscles; then a course of massage until the swelling has subsided and all the movements of the ankle and foot have been regained and are painless, with the temporary use of a foot-brace if necessary.

In conclusion, the history of many of these patients would seem to show a very discreditable ignorance among physicians as to the appearance of a normal foot and of the injuries and diseases to which it is liable. A sufferer from non-deforming club-foot, persistent abduction of the foot, or flat-foot, usually goes from physician to

physician only to receive a prescription for a new liniment or anti-rheumatic medicine.

Even when a correct diagnosis is made, surgeons are too often content with temporary relief, rather than insisting on the persistent treatment which may result in cure.

DISCUSSION.

Dr. George W. Ryan, of Cincinnati.—So excellent a paper deserves a discussion. I believe that there is a distinction in this class of cases which was not brought out in the paper. It may be remembered that at the Washington meeting I reported a case of reflex valgus. In this paper we have a class of cases, similar to it in every way, designated as chronic sprain. In the case I reported, I inquired into the history thoroughly. The family gave a history of injury, but it was not a clear one; I was not satisfied with it. It was a question in my mind about its being a pure neurosis. A sprain might give rise to such a condition Possibly the treatment recommended by correcting the position of the foot, giving it absolute fixation, or dividing the tendon, might be of service where the line is properly drawn. Why one case is one of chronic sprain and the other a case of neurosis, I am not clear myself.

There are many cases, undoubtedly, of the class described in the paper which are the direct result of injury, and should, of course, be termed chronic sprain. It is not improbable that in a few the neurotic element is marked in a pure sprain. With all these, however, certainly many of us have seen cases—I have, I am sure—that presented symptoms exactly like those given us this afternoon, in which there could be no question that there was a neurosis uncomplicated by injury present. They must be treated after other methods to secure good results.

Dr. James K. Young, of Philadelphia.—I would like to suggest rubber coating for these springs. If coated with hard rubber it prevents rusting, and they last indefinitely. They are coated in the same manner that trusses are covered with hard rubber. A sheet of thin, hard rubber is placed on either side of the plantar spring, and

by means of heated rollers the edges are approximated and hermetically sealed.

Dr. E. H. Bradford, of Boston.—I stated at our Washington meeting, since Dr. Whitman has called attention to it, that I have used his brace a great deal at the hospital, and I find it an excellent one in every way.

Dr. Taylor, of New York.—I merely wish to add a word to what Dr. Ryan has already said—namely, that a good many cases called "chronic sprain" may be neuroses. Some start with a sprain, others do not. They linger along, sometimes for a great while, under various modes of treatment, and the disability and pain may be great. Some of the cases I speak of are pure neuroses, and some of them can be cured without treating the foot. I do not doubt that the cases Dr. Whitman describes are of a different character, but cases into which the neurotic element enters are not rare, and it is practically very necessary to recognize them.

Dr. Whitman.—I have used the term "persistent abduction" to describe a common affection which is not flat-foot, though allied to it in its causes and symptoms. Cases of persistent abduction may be divided into two groups: One, in which there is a distinct history of traumatism with persisting and increasing disability; another, usually in young subjects, where disordered reflexes greatly exaggerate the local trouble. In these cases the history is more obscure, the pain less prominent, while the deformity and muscular spasm are more marked. The pure neuroses mentioned by Dr. Taylor must be very rare, and in these cases the history, symptoms, and appearances should be sufficient to distinguish them from the affection which has been described. In all affections of the foot, however, the necessity of treating the general as well as the local condition should be borne in mind.

Furthermore, I would not wish to be understood as saying that sprains are followed, as a rule, by persistent abduction, but that, in a certain number of severe sprains, where the injury affects the internal ligaments of the foot, the patient does not recover. In these cases, the foot examined some months or years later will present the symptoms and appearances of persistent abduction. This possible termination should be guarded against by a more careful treatment of recent injuries.

THE NERVOUS AND MUSCULAR ELEMENTS IN THE CAUSATION OF IDIOPATHIC LATERAL CURVATURE.

By BENJAMIN LEE, A.M., M.D., Ph. D.,
PHILADELPHIA.

Propter ovarium est mulier—Woman exists for the ovary. The ovary is dominant in the scale of her physical harmonies. Let that organ lose its normal tone, and discord soon manifests itself in some portion of her nervous system. Up to a certain age it remains dormant, and, given similar conditions of life, training, and *régime*, there is little to mark the difference between the boy and the girl. But when once this gland has taken on its functional activity, all this is changed, and the budding woman becomes liable to numerous distresses and disorders which her more fortunate brother never, or rarely, suffers from. When both were infants in arms, their backs —that is to say, their spinal columns—were nearly straight, deviating from a right line neither forward nor backward, neither to the right nor the left. As they began to bear their weight upon their feet, to balance themselves and to walk, gradually these straight spines began to curve, forward in the lower segment, backward in the middle segment, and again forward in the superior segment. The first of these curves took place in the lower or lumbar region as the result of increased tonicity in two important muscles known as the psoas magnus and the iliacus internus. The other curves were compensatory, rendered necessary in order to preserve the equilibrium of the body and afford all the organs room for free play and complete discharge of function.

But now, for the possessor of the ovary comes the monthly molimen, which, for the next thirty or forty years of her life, is to regulate all her movements. This imperious organ becomes en-

gorged with blood, takes on an intense excitement, sets all its nerves to vibrating, and arouses the sacral plexus into a state of sympathetic energy. In many cases the sacral plexus, in its turn, communicates the unwonted stimulus to the pelvic spinal muscles, of which mention has just been made. These muscles contract under the stimulus, and the result is a backache such as the sufferer never felt before. The means to which she naturally resorts for relief is to lie down and place her hand, or some other firm body, under the small of the back. This supports the arch formed by the contraction of the muscles, allows them to relax, and diminishes the suffering. When the flow of blood from that obedient slave of the ovaries, the uterus, has relieved their congestion, their excitement diminishes; this intelligence is communicated to the sacral plexus, which, in turn, telegraphs to the muscles, and they soon subside into their normal condition, only to be again stimulated to undue contraction when the moon shall have completed another revolution around the earth. In many women this pain is slight, in some entirely absent; but it is safe to say that it is the most common form of suffering attendant upon menstruation. And even when there is no consciousness of pain, it does not follow that a certain degree of muscular contraction has not taken place. We have these muscles, then, subjected at very frequent intervals to an influence which unduly excites their contractility. Is it to be wondered at that this intermittent, abnormal contractility should sometimes lead to a permanently irritable condition of the muscular tissue? So long as these symmetrical muscles act with equal energy on both sides of the flexible spinal column, its equilibrium will not be disturbed, so far as lateral deviation is concerned. But if, for any reason, those of one side act more vigorously or more persistently than their fellows, the result must be a gradual inclination of the spine toward the side of preponderating contraction. The same effect will, of course, be produced if those of one side suffer a loss of tone. Now, bear in mind that these muscles have an entirely different relation to the motility of the spine from that possessed by the muscles of the upper part of the trunk, in that their attachments are to a fixed point of support which is in contact with the earth, while those of the former, such as the rhomboideus and trapezius, are to entirely movable points. The direction of action is here precisely reversed. The spine itself is the fixed point,

so far as the superior muscles of the trunk are concerned. When they contract they do not draw the spine toward their opposite extremities, but their opposite extremities, with the limbs to which they are attached, toward the spine. Only under one condition can they disturb the spinal equilibrium, namely, when the hand grasps an object which is firmly attached to the earth. Then they act with the same advantage that the pelvic spinal muscles possess in that respect.

There is, however, another mechanical consideration to be borne in mind. Acting from the pelvis as a fixed point or centre, the spine forms the radius of a circle. A very slight degree of deviation from the perpendicular near its pelvic extremity therefore means a very considerable deviation at its capital extremity. Hence, as the maintenance of equilibrium is the first necessity, a very small lumbar curve will necessitate a large dorsal compensating curve. It is not strange that the comparatively trifling lumbar curve often goes unnoticed, and that the large dorsal curve is the first to attract the attention of the mother or the dressmaker. In fact, in the large majority of cases, the mother does not detect the former, even when it has become aggravated, until the surgeon points it out to her. I have said that, under ordinary circumstances, it is not conceivable that the use of the muscles which move the upper extremity should draw the spine toward the extremity. The extremity must, of necessity, be drawn toward the spine. We cannot attribute the dorsal curve to direct traction by those muscles, however excessively they may be developed. But there is an indirect action upon the equilibrium which must not be overlooked, and which will aid in the solution of our problem. Every time that we make a vigorous movement of the right arm, we instinctively throw our weight on to the left leg, with the double object of preserving the equilibrium and of obtaining a stronger *point d'appui* for the effort.

The result of this constant use of the left leg as the antagonist of the right arm is to make it the stronger of the two. We even find in a large proportion of individuals the left foot the larger. In this general disproportionate development of the muscles of the left leg, of course, the pelvic spinal muscles share. If they are in a perfectly healthy condition, however, their increased development does not induce abnormal contraction, and there is no disturbance of equi-

librium. But if they are in a state of morbid irritability, it is not difficult to understand that the excessive strain upon them may lead to an abnormal contractility approaching tonic spasm.

I do not forget that when this subject was under discussion at the Washington meeting, Dr. Ketch made the statement that in two hundred and twenty-nine cases of lateral curvature which he had analyzed, he had found forty occurring in boys. This fact, taken as it stands, is enough to point to some sexual influence as a strongly predisposing cause, showing that only a little over seventeen per cent. of the cases were found in boys. But I strongly suspect that all forms of lateral deviation of the spine were included in this analysis, and that if such as are dependent on rhachitic degeneration, pulmonary or pleuritic inflammation, inequality in the length of the limbs, and accidents of various kinds, had been eliminated, the disproportion would have been greatly increased.

It is quite possible to conceive that sexual irritation arising from preputial malformation may produce in the male during the period of awakening sexual energy precisely the same disturbance of the pelvic ganglia that ovulation does in the female. We know how frequently both paralysis and spastic contractions can be traced to this cause.

Viewing the general question of the precedence of the curves from a clinical standpoint, I would request the members to note particularly in their cases in the very earliest stage whether, with very slight dorsal curvature and rotation, they do not often observe quite marked distortion of both kinds in the lumbar region. Such has been my own experience, and it was that which led me to the line of thought which I have now hastily sketched.

A DETERMINATION OF THE MUSCULAR STRENGTH OF GROWING GIRLS AND ITS RELATION TO THE ETIOLOGY, TREATMENT, AND PROGNOSIS OF LATERAL CURVATURE OF THE SPINE.

By CHARLES L. SCUDDER, M.D.,
BOSTON.

In order that the surgeon may treat each case of lateral spinal curvature intelligently, and that scientific data may be accumulated by which a study of the etiology of this disease may be furthered, greater precision and a more extended observation are demanded in the recording of such cases. Hitherto careless methods or no method at all have been used. A rough sketch, a photograph, a general impression have served as records, or after Mr. Roth, of London, a tracing has been made of the rotation present. In all the past the object has been, in making these records, simply to have a rough guide as to the progress of the disease. Instruments of more or less precision are now being used by a few in the study of these cases. It is in this direction, rather than in any other, that we must look for progress in our knowledge of lateral curvature.

The value of most statements, hitherto, upon the muscular element in the etiology has been greatly lessened by an entire absence of carefully recorded facts. The muscular theories have been numerous. The following are the views held by a few:

Guérin attributed lateral curvature to active muscular contraction. The muscles on the concave side of a curvature are actively contracted, and become permanently fixed in this position.

Malgaigne taught that lax ligaments and weakened muscles form the predisposing causes to spinal curvature.

Bernard Roth[1] thinks that lateral curvature is predisposed to by weakness of the spinal muscles, combined with long-continued sitting or standing in stooping or relaxed positions. He has observed an inherited weakness of muscles and ligaments, associated probably with excessive softness of bones. He writes: "Anything which weakens the muscular system tends to produce lateral curvature."

Adams[2] believes that, in the early stage of lateral curvature, the spinal muscles on both sides are, as a general rule, decidedly passive; but that, as the curvature advances, the muscles on the convexity are called into increased action and serve the purpose of limiting the extent and preventing the increase of the spinal curvature.

Dr. L. A. Sayre[3] believes that rotary lateral curvature depends entirely upon abnormal muscular contraction. The spinal column is held in its normal position by the contractions of muscles situated upon either side of it, which should exactly balance each other. If, for any reason, one set of muscles overcomes the set upon the opposite side, the spine yields and a curve is produced with its concavity toward the side upon which the stronger set of muscles is situated. Dr. Sayre differs from Adams in placing the strong muscles upon the opposite side of the body.

Schreiber believes that in the early stages of the scoliosis there are no changes in the muscles. The muscular changes, he thinks, are due to long-continued stretchings and disuse.

Eulenburg holds that slight continuous muscular action is necessary for the maintenance of the upright position of the body. This action must be equal on either side of the spine. The most frequent cause of deviations of the spine is a disturbance of the power of the spinal muscles. By the frequently repeated passive torsion, necessary in assuming faulty positions, gradually the trunk muscles are weakened.

Lorenz is correct in his criticism of the Eulenburg theory, when he says that muscular insufficiency is quite a gratuitous and unproven assumption.

Lorenz sums up his criticism by the statement that anatomically,

[1] The Treatment of Lateral Curvature of the Spine, with Appendix. Bernard Roth, F.R.C.S. London: H. K. Lewis, 1889.

[2] Curvature of the Spine.

[3] Orthopedic Surgery.

pathologically, and clinically there is no foundation for the theory of a disturbed muscular antagonism.

That there is an element of muscular weakness present in cases of lateral curvature, pure and simple, has hitherto been assumed.

Believing, as I do, that it has been pretty satisfactorily demonstrated that two important factors in the production of the deformity are (*first*) the superincumbent weight of the head, neck, upper extremities, and trunk falling upon (*second*) a spinal column which is out of plumb, the question arises, What position should the muscular factor occupy in the etiology? Is the assumption of muscular weakness in cases of lateral spinal curvature justifiable?

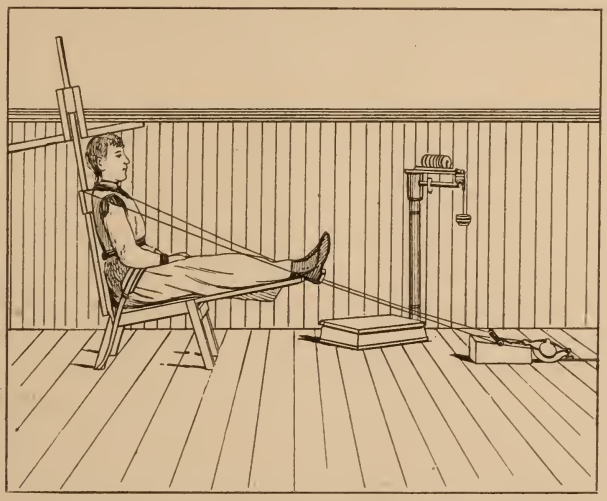
Before being able to determine the presence or absence of muscular weakness, it is necessary to establish a standard of strength for the back muscles for each age of the growing child. In order to establish this standard I have made an examination of the backs of 1141 of the schoolgirls of Boston. There was constructed for these examinations a chair with hinged and movable back, at right-angles to a seat slightly inclined from the floor and long enough for the child to rest comfortably the legs upon. The back, at the level of the shoulders, is connected by stiff iron rods to the handle of a dynamometer, graduated in kilogrammes and fractions. Attached to the back of the chair is an upright with a cross-piece, movable up and down, by means of which the height both standing and sitting was taken. (See Fig. 1.)

Each child was weighed, and her height taken, both standing and sitting. Then, upon sitting in the chair, a strap was passed over the hips (to prevent slipping forward), the arms were folded, and the child forcibly extended her back upon the thighs. The back of the chair was then raised to above the level of the occiput, and again the muscular strength was taken—this time testing principally the trapezius and deep muscles of the neck and upper back The muscles used in the first test are chiefly those of the lower back. The action of the thigh and leg muscles are as nearly as possible eliminated by raising the legs on the inclined seat. The amount of the pull or the strength of the back muscles is recorded upon the self-registering dynamometer.

The results of these observations are seen, in part, upon the chart. There is found to be a gradual increase in the strength of the back

muscles of growing girls with each year's increase in age from ten to nineteen. There were no marked cases of deformity among these

Fig. 1.



Chair for measuring the strength of the spinal muscles.

Fig. 2.

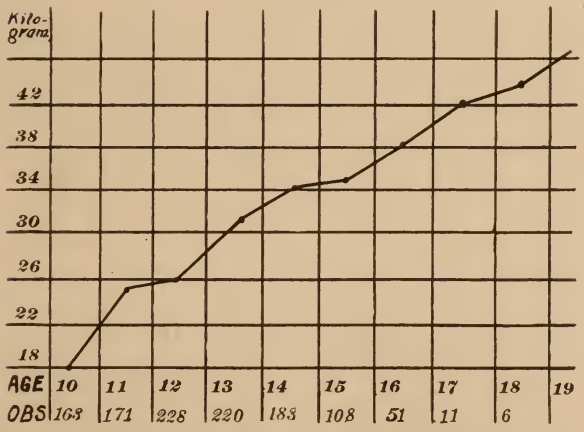


Chart showing the strength of the back muscles for each age of healthy girls.

children; and the results are taken to represent the average strength of the backs of growing girls, irrespective of nationality.

We possess, then, an index of muscular strength for each age in healthy girls from ten to nineteen.

It is now necessary to measure the strength of the backs of lateral-curvature patients during all stages of the disease from its inception —when it has been assumed by some that there is, and by others that there is not, muscular weakness present—to the period of osseous change, when it has been proven by autopsy that the spinal muscles are so altered or replaced as to have no contractile power.

These two groups of observations—first, of normal backs; second, of lateral curves—when completed and compared, will demonstrate the presence or absence of muscular weakness in the different stages of lateral spinal curvature. It will thus be possible to determine the history of the muscular strength through the various stages of the disease. And the muscular element in its etiological importance may then be discussed intelligently in one of its aspects.

Muscular exercise indiscriminately prescribed in cases of lateral curvature is irrational. The presence of habitual faulty attitudes does not necessitate the assumption of muscular weakness. The importance of determining the presence of muscular weakness and of measuring it, is greatest when the deformity is slight and the child is apparently strong. Treatment by posture and exercise is successful in the great majority of cases in the non-osseous stage. But I am convinced that the application of this treatment will be more rational if each case shall be compared with what may be designated the physical index of development. This physical index, for any child, is the height and weight and strength which that child ought to have at its age as determined by the tables of Bowditch and the table given above.

From the researches of Dr. H. P. Bowditch, of Boston, it is known what the height and weight of growing girls should be at each age. It is known approximately, from the results of the investigation presented to you to-day, how strong the back muscles should be for each age. With all these data at hand it is possible to determine whether a given patient is up to the standard of development or not. Special muscular exercise can then be prescribed when it has been demonstrated that it is needed. Mr. B. Roth's method of determining the need for muscular exercise is an excel-

lent one, but with this additional test treatment is placed upon a firmer and more accurate basis.

The ordinary method of marking improvement or not is by comparing the rotation tracing taken at intervals. In some cases, however, the rotation may remain constant, and yet the attitude of the child improve with the increase of muscular strength. The tracing, in such cases, will not be of great value. But a measure of the muscular strength at intervals will serve a valuable index of progress. Then, again, in those cases in which there is no rotation present, by making measurements of the muscular strength at intervals the value of the muscular treatment will be demonstrated. And, again, in those cases in which the rotation diminishes by treatment, the tracing may be supplemented by a test of muscular strength.

A committee on lateral curvature of the spine appointed by the Clinical Society of London, reported that "the amount of improvement which may be hoped for in any given case may not unsafely be gauged by the improvement which the patient can voluntarily effect (directed or helped by the surgeon) in her position when first seen."[1] In addition to this, the relation existing between the age, the height, the weight, and the muscular strength of any given individual will assist in forming a prognosis.

There is, of course, a normal relationship between the several factors of the physical index. If, upon examining any given child, she is found to vary in any one or more points from the standard, it may then be considered whether this variation is to be taken as one of the etiological factors or not.

In conclusion:

1. I believe that to-day has been established a scientific basis for the study of the muscular element in the etiology of lateral spinal curvature.

2. Suggestions have been offered as to the bearing of these observations upon (*a*) the treatment, (*b*) the records, (*c*) the prognosis, in cases of this disease.

[1] See Clin. Soc. Trans., vol. xxi., 1888, p. 301.

THE ETIOLOGY OF LATERAL CURVATURE.

By ROBERT W. LOVETT, M.D.,
NEW YORK.

The subject of the etiology of scoliosis is not one which can be made original or interesting, and brevity seems the only merit attainable for my paper.

In no department of orthopedic surgery has the modern change of opinion been more noticeable than in regard to lateral curvature and its time of appearance. Formerly regarded as an affection beginning at or about the time of puberty, it has been shown by investigation to be a deformity of much earlier life than had been supposed.

I need only call your attention to the well-known figures of Ketch and Eulenburg. Ketch, in 229 cases from the New York Orthopedic Hospital and Dispensary, found that 52 per cent. began between the first and twelfth years; 41 per cent. began between the twelfth and eighteenth years; and only 3 or 4 per cent. after the eighteenth year.

Eulenburg, in 1000 cases, found 78 between birth and the sixth year; 216 between the sixth and seventh years; 564 between the seventh and tenth years; 107 between the tenth and fourteenth years; 35 after the fourteenth year; or 85.8 per cent. occurring before the tenth year.

Congenital cases are described, but generally in connection with congenital rickets, anencephalous deformity, and the like.

Sex exercises a very marked influence, which is not altogether to be accounted for, because, as we have just seen, the great majority of cases occur before sexual characteristics are very well marked, and the enormous preponderance of girls finds no very satisfactory explanation beyond the fact that their growth is more rapid than that of boys, and in the city at least, in their growing years, the

conditions are not such as to favor their muscular development. Nevertheless, this hardly seems enough to explain the great preponderance of girls.

Vogt explains a certain part of this in calling attention to the fact that if parents were as solicitous about the figures of their boys as in the case of their girls, the proportion of males would be much larger. The proportion of girls to boys has been variously stated. Eulenburg would set it at 10 to 1; Drachmann as 4 to 1; Kölliker as 5 to 1, etc. Adding together the groups of cases reported by Adams, Kölliker, Ketch, Roth, Behrend, and Wildberger, one finds 1974 girls and 365 boys, or about 5 to 1.

No factor is more important than the condition of the general health of these patients. As a rule, they are distinctly below the average in muscular development, and in vigor of circulation they leave much to be desired. They are prone to intercostal neuralgias, the digestion is likely to be feeble, the hands and feet are cold, and in some instances at least the curvature is associated with defects in one or both eyes. Very often one sees cases of marked lateral curvature where the muscular development is decidedly above the average, but they are exceptional, and, although the lack of good condition in cases of lateral curvature is not, as a rule, extreme, it is generally so well marked as to be noticeable.

The influence of heredity is sometimes mentioned, but it seems very questionable if it plays a very important part in predisposing to the disease more than by transmitting a general feebleness of the constitution. Mr. Adams would class cases occurring under twelve years as hereditary, but this would seem to be an insufficient evidence.

So far, the factors that have been mentioned may be classed as predisposing causes of the affection. In turning to the more immediate causes, one finds certain cases where it is plainly evident what caused the curvature; but in the majority of cases the cause lies hidden in the deepest obscurity, as is made evident by the many fanciful reasons adduced to account for the affection.

Among the cases where the cause is evident may be classed those resulting from:

(*a*) Empyema.

(*b*) Infantile paralysis.

(*c*) Cerebral paralysis.
(*d*) Hereditary locomotor ataxia and pseudo-hypertrophic paralysis.
(*e*) Rickets.
(*f*) Pott's disease.
(*g*) Certain cases from occupation.
(*h*) Various miscellaneous causes, such as the loss of an arm, and the like.

It is hardly worth while to comment upon the very obvious way in which any one of these may cause lateral curvature (except in class *d*, where it can only be said that scoliosis is very commonly found). It will therefore be better to pass on at once to the larger and much more obscure class, where no such evident causes are to be assigned.

There are three classes of theories which would explain the occurrence of lateral curvature on three widely different grounds. These are, first, that the distortion is due to unequal muscular action of the two sides of the body; second, that the affection is due to unequal bony growth of the two sides; third, that the cause of the deformity is to be found in the superincumbent weight which comes upon the spinal column in a faulty position.

It hardly seems worth while to take up your time with a catalogue of the theories which have been advanced to account for the occurrence of scoliosis. Their number is legion, and most of them have only to be mentioned to be dismissed. A fairly complete list of them may be found in Reeves' *Practical Orthopedics*.

(1) To return once more to the theories which find adherents today, and to consider first the place of the theory that the causation of the curvature is to be found in unequal muscular action. The idea of Guérin is no longer tenable, that an active unilateral muscular contraction is the cause. Stromeyer and Barwell speak of contraction of the serratus muscle as being at the root of the trouble. But clinical evidence is wanting to establish the facts in question, for, as far as can be seen in early cases, the muscles of both sides react alike to all tests to which we can put them, and evidences of active contraction are not to be found.

In the modified form of the muscular theory identified with the name of Eulenburg, however, there is much that is satisfactory. He states that, inasmuch as continuous muscular effort is necessary for

the maintenance of the erect position, it happens, if any of the muscles are weakened and fail to do their work, that the spinal column will bend and assume a faulty position, thereby stretching and still further disabling the muscles already weakened. In this way the assumption of the same bad attitude will, in time, lead to a permanent curve.

Evidence is wanting to show the primary weakness of the muscles of either side. Their electrical reaction is the same, and it has been said that to all available tests the muscles of the two sides appear alike. Moreover, lateral curvature develops at times in exceptionally strong individuals, nor is it plain that slight stretching of the muscles is so important a factor in weakening them. Nevertheless, although the theory cannot be accepted as the explanation of all cases, or, perhaps, as the sole cause of many, it does at least serve its purpose in calling attention to the importance of muscular weakness as a factor in the production of scoliosis.

(2) The second theory, that of abnormal bony growth, has less to commend it.

Hueter and Engell believe that one side of the chest grows much faster than the other, and that the ribs ossify prematurely, contributing to the distortion.

Such changes are not, however, found in early cases; and, moreover, the early flexibility of the column and the disappearance of the curve during recumbency, would tell strongly against the theory, if it were worthy of serious refutation.

Lorinser would account for scoliosis as the result of subacute inflammatory changes in the structure of the bone.

Rickets, or a similar affection, is advocated by many writers as being the cause of most cases of lateral curvature. But, apart from the cases of scoliosis which are clearly rhachitic, and shown to be so by the general involvement of the bony system, ordinary cases of lateral curvature show no evidences which can bring them legitimately under the head of rickets. Epiphyseal enlargements are not present; bony changes elsewhere than in the back are not to be found; and the history of the child gives no account of late dentition, delayed closure of the fontanelle, sweating, or any of the classical symptoms of rickets. It is evident, therefore, that if these cases are rhachitic, the process is an anomalous one, unknown to

the pathology of to-day, and it must be evident that it is unjustifiable to speak of cases of scoliosis as rhachitic when all the diagnostic signs of that affection are absent.

(3) The third theory would find the cause of lateral curvature in superincumbent weight falling upon a column which is not supported in a correct position. It is to this last view that the weight of modern opinion is continually tending.

Certain anatomical experiments were undertaken by Dr. Bradford four years or more ago to ascertain whether the changes found in severe scoliosis were such as could be produced by superincumbent weight. It was found by a series of experiments upon the cadaver that when downward pressure was exerted upon the spinal column in an erect position, a backward bending took place, which became a lateral bending when a certain point was reached, reproducing the features of a true scoliosis, including the typical rotation. Several experiments showed the same point.

In the course of the experiments it was found to be impossible to prevent the weight from coming somewhat obliquely upon the column; and the more obliquely it came, the more marked became the scoliosis. What the experiments showed was that superincumbent weight can cause scoliosis when falling upon a column held even a little obliquely. This, at first a physiological affair, becomes quickly pathological, on account of the pressure-changes which result.

It is easy to see how, in connection with a certain amount of muscular weakness, this comes about, and especially how lateral curvature is favored by the existence of a short limb, or any cause which tends to render the pelvis oblique.

The importance of a short leg in the causation of scoliosis seems, however, to have been overestimated. It may be decidedly a predisposing factor, but of itself it can only count for little, because the existence of a short leg is so exceedingly common; Morton's figures need only to be quoted to establish that point. He measured 513 healthy boys, and found 272 with inequality in the length of their legs. And Garson, of London, in measuring the leg bones of 70 skeletons, found the lower limbs of equal length in only 10 per cent.

It is thus easy to see how faulty attitudes predispose to scoliosis by rendering the pelvis oblique and making the superincumbent

weight thus come obliquely upon the column. The faulty attitudes may be, in the first instance, the result of muscular weakness, but they are so important a factor in the causation of scoliosis that every possible means should be taken to correct and prevent them.

In concluding this very hasty summary of opinions in the matter, I can only join with you in regretting that nothing more tangible or more definite can be offered.

THE ROTARY ELEMENT IN LATERAL CURVATURE OF THE SPINE.

By A. B. JUDSON, M.D.,
NEW YORK.

The method of accounting for the rotation attending lateral curvature of the spine which I proposed about fifteen years ago,[1] occurred to me when preparing a lecture on lateral curvature for the Women's Medical College in New York City. It seemed to me then, and I have seen no reason to change my opinion, that rotation takes place because the anterior part of the column, the bodies, are free to move laterally in the cavity of the chest and abdomen, while the posterior part of the column, the processes, are prevented from the same degree of lateral displacement by being entangled in the posterior parietes, composed of ribs, muscles, and fasciæ. This anatomical disposition of the part is recognized when a subject is eviscerated on the dissecting-table. The vertebral bodies are seen projecting strongly into the cavity of the trunk, while the vertebral processes are fused into the parietes, as need not be mentioned to anyone who has dissected in this region. This arrangement is also seen in Fig. 1, which is copied from a drawing made by Mr. Alexander Shaw for Sir Charles Bell's *Practical Essays*.

The rotation attending lateral curvature may be seen in the preparations found in every pathological museum. Curvature, with due rotation, may also be produced in a preparation like that shown in Figs. 2, 3, and 4, in which the vertebræ of a normal spine are assembled under mechanical conditions similar to those found in the body. They are strung on a rod which is flexible laterally, and the spinous processes are hindered from wide lateral excursion by elastic spiral wires. The column thus arranged, when subjected to down-

[1] Transactions of the New York Academy of Medicine, 1876, pp. 315–330.

ward pressure, exhibits rotary lateral curvature, and when the middle of the column is restrained we have a compensating curve with its appropriate rotation, exactly as we have them in the healthy or diseased spine.

Fig. 1.

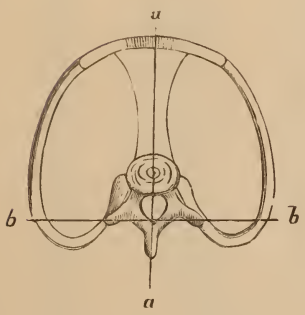
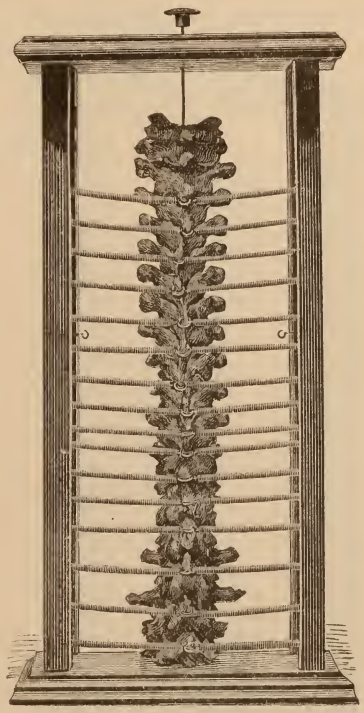


Fig. 2.



When we consider a single vertebra in rotation, it is seen that, as it moves away laterally from the median line, the body makes a wider excursion than the spinous process, the body moving three-fourths of an inch, perhaps, while the process may move one-fourth of an inch, and this constitutes rotation. The vertebra does not have rotation on a central axis, as shown in Fig. 5; neither does it have rotation on a peripheral axis, as in Fig. 6, but it performs its rotation on an eccentric axis, one remote from the periphery, and still further removed from the centre, as is shown in Fig. 7.

The lateral curvature is less in the processes than in the bodies—a very important point in an effort to appreciate the extent of the

deformity, the gravity of the case. It follows logically, and is also true in practice, that an earlier diagnosis can be made by looking for rotation than for curvature.

Fig. 3.

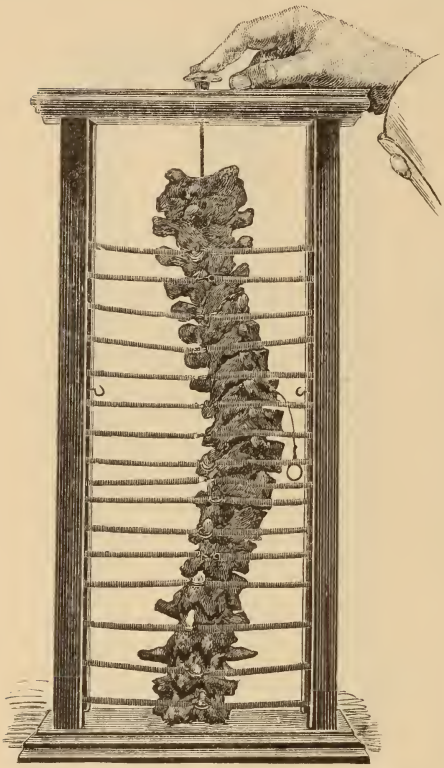
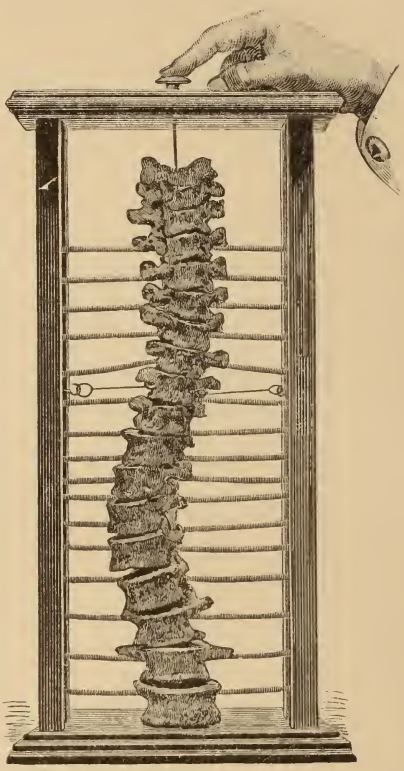


Fig. 4.



It will be found that this theory of the production of rotation agrees with all the phenomena which are observed in lateral curvature. For instance, the rotation is greater or less according as the curvature is greater or less; in the compensating curve the rotation as well as the curvature is reversed; and in the cervical region there is no rotation, because there is no cervical cavity corresponding to the thoracic and abdominal cavities.

It is an interesting fact that rotation is physiological as well as pathological—that is, it occurs in health as well as in disease. It is one of the functions of the normal spine. Lateral curving of the

spine cannot occur without it. It adds a sinuous grace, which is difficult to describe, to attitude and action, as may be observed by close attention in the gymnasium. It may be easily demonstrated in a thin person by observing the prominence caused by the transverse processes on the side of the convexity of the curve, a prominence which has not infrequently, in patients affected by extreme lateral curvature, been mistaken for a morbid tumor.

Fig. 5.

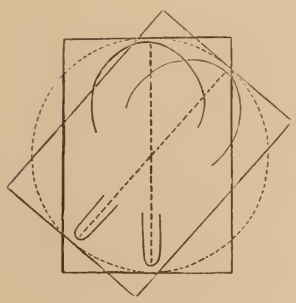


Fig. 6.

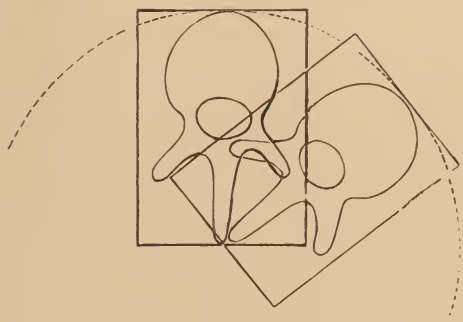
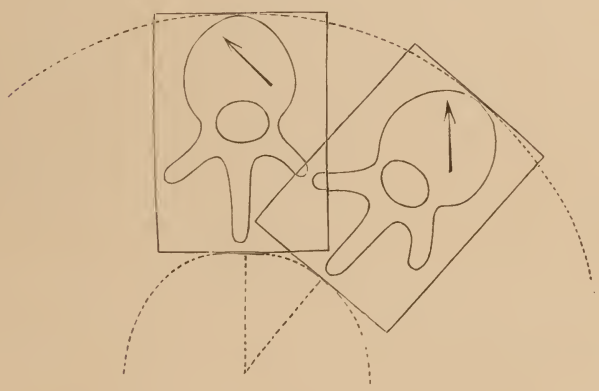


Fig. 7.



It is probable that the apparent deflection of the track of the bullet in the case of President Garfield was caused by the rotation of the spinal column accompanying strong lateral curvature. The track of the ball was found, post-mortem, to traverse the vertebral body from right to left and from behind forward, as shown by the direction of the arrow in Fig. 7. It will be remembered that the

assailant was behind and to the right. I suppose the first shot was harmless and caused the President to look over his right shoulder. Seeing the murderer preparing to fire again, he leaned strongly forward and toward the left, instinctively making the outline of his figure as small as possible, doubtless quickening his steps at the same time. This lateral curve of the spine threw the vertebral bodies far to the right, and they received the missile coming directly from behind. The concussion of the cord produced temporary paralysis, the victim fell, and the spinal column in straightening gave to the track of the ball the appearance of deflection.

The presence of rotation seriously complicates the question of treatment, because, when lateral pressure is applied to the ribs for the purpose of straightening or supporting the column, a portion of the pressure at least reaches the column so far back by reason of the articulation of the ribs with the transverse processes that it may even promote rotation, or, at least, prevent its reduction. If we could invade the cavity of the trunk and make direct lateral pressure on the bodies of the vertebræ, we might happily oppose at once the rotation and the lateral curvature.

An early diagnosis may generally be made by looking for rotation, which may be recognized by asymmetry of the scapulæ and by palpation of the chest between the two palms, which will reveal a difference in the diagonal diameters of the chest when curvature is slight or overlooked in the line of the spinous processes. If, for instance, there is rotation of the body to the right in the dorsal region, the diameter of the chest from the angles of the right ribs to the left mammary line will exceed the diameter taken from the angles of the left ribs to the right mammary line.

In the absence of accepted views of the etiology of lateral curvature, I assume that the deformity is an expression of inability on the part of the muscles (very likely of nervous origin) to hold the trunk erect. I am led, therefore, to advise the patient, in the first place, to give up tasks of all kinds, to practise reasonable methods of improving the health, to avoid treatment which involves muscular fatigue, and, instead of trying to hold the spine erect, to take and keep the recumbent position at will. In the next place, I advise the patient to adopt persistently, for as many hours in the twenty-four as is possible, those attitudes in which the spinal column is as

nearly symmetrical as may be, assuming that the increment then taking place will be on the right side of the dividing line between deformity and symmetry. The supine position, in which perfect repose is maintained with the nearest approach to symmetry, should be taken during the hours of sleep, and as much of the time during the day as is practicable. In the third place, I seek to produce lordosis of the dorsal and lumbar regions, on the theory that the patient is thus led to remove the imposed weight, or a part of it, from the bodies of the vertebræ, which deviate widely from the median line, to the articular processes which, in virtue of rotation, remain comparatively near the median line. This may be done by suspension on the curved back-board, and also by using an air-pillow about ten by eighteen inches (No. 2), placed under the back when the patient is supine, in such a manner that the shoulders may fall into the space between the air-pillow and the pillow for the head, and the pelvis may hang over the lower edge of the air-pillow. This position is to be assumed whenever the patient is recumbent, day or night.

In passing, I would say that suspension by the upper extremities, in any of the forms in which it is practised, is to be encouraged up to, but not beyond, the point at which it causes fatigue. In this way we can forcibly and directly separate the chest walls for the purpose, first, of opposing deformity, which lessens the capacity of the chest; and, second, of fortifying the health and strength, which depend largely on unimpeded respiration.

I am unable to express confidence in the use of braces applied for the forcible arrest or reduction of curvature. I can understand the application of force to straighten the knee, with pressure from before backward in the neighborhood of the joint, and counter-pressure from behind forward at points remote from the joint on the bony levers which compose this joint, but am at a loss when I try to straighten by pressure a column composed of a score of short-jointed bones thrown into a double or triple curvature with the added complication of rotation in two or three directions. The only way in which I could hope to produce a favorable effect by direct force is to apply pressure by means of a steel brace from behind forward in such a way as to favor lordosis of the whole column. In this way, it is quite conceivable that when the patient is erect, both the

primary and the compensating curves, and the rotation accompanying them, may be mitigated by a transference, as in the mechanical treatment of Pott's disease, of a part of the weight from the bodies, which deviate widely from the median line, to the processes which, by virtue of their anatomical connection, are held comparatively near the median line.

A general clinical view of the subject leads to the opinion that lateral curvature is not always a serious affection. It is certainly true that many persons lead happy and laborious lives with a marked deformity which is recognized by the dressmaker, and almost no one else. In view of this we can better reconcile ourselves to the admission that it is impossible to reduce a curvature which has passed the incipient stage. On the other hand, it is also true that in cases of exceptional severity the kyphotic deformity is extreme, rivalling the worst results of spinal caries. Treatment should, therefore, be thorough and persistent in the case of a growing patient. We may thus reasonably expect to avert serious deformity and approximate symmetry as closely as the nature of the case will admit.

DISCUSSION.

Dr. George W. Ryan, of Cincinnati.—I am prepared to discuss the treatment rather than the causation of rotary lateral curvature; I believe the muscular element is an important factor in this disease.

The first paper we listened to was an ingenious argument, exceedingly well put, but my experience has been such as not to lead me to put a great deal of confidence in it as being proven. Some of the points brought out were very interesting. There are some facts in connection with the clinical history of lateral curvature which will bear them out, but they are not sufficient wholly to sustain it. The striking fact which gave plausibility to the paper is, that the element of sex plays a large part so far as causation is concerned. A very large proportion of the cases occur in girls, but we have seen rotary lateral curvature in the growing boy of fifteen as fully developed and marked as in girls under the same conditions.

The question of general health, which was touched upon in

another paper, struck me as an interesting point. My experience has been that patients with rotary lateral curvature are generally in exceedingly good health. Women with old curvatures who have passed the age of twenty-five years are more likely to complain, but it is rare for young girls to complain of pain—so rare, in my experience, that if they should do so I would suspect another lesion. The general health is usually good. I am speaking now solely from my experience. I have seen a number of cases in girls that I consider robust.

There is one thing I have always believed. It is, that rhachitis is a cause of lateral curvature in a considerable proportion of cases. The relation it bears to this disease is, I think, under-estimated. One fact that Dr. Ketch pointed out in his paper was the number of cases which develop before the twelfth year, and the clinical fact of other rhachitic changes taking place in the bones, has led me to place a good deal of confidence in the rhachitic origin of the disease. I believe many cases come on within the rhachitic period; they develop at the age of puberty—that is, they become much more marked and take on another growth, as it were. I believe many of the cases are due to rhachitic changes in the bones and ligaments of the spine. These changes are accentuated by the age of puberty. There is no question but what puberty is of considerable importance, on account of its influence on many other conditions. There is a muscular deposit which takes place, and an increase of muscular tone, and a loss of this muscular tone is a factor of great importance.

The question of short-leg is something that a few of us happened to discuss last night. Its bearing, I think, was very well shown here this morning. I do not believe in my experience I have seen a case of rotary lateral curvature which could be accounted for by a short leg. There is no question but what it does occur in children who may have a short leg, but I believe it is merely a coincidence. It may have some bearing, but it would never determine lateral curvature. I do not believe it can be demonstrated by the number of cases of children who have shown disease of the extremity and have developed short limbs, that they are really the cases in which we see rotary lateral curvature.

Dr. E. H. Bradford, of Boston.—It may be interesting to the gentlemen of the Association to know that, bearing on the point of

etiology of lateral curvature, there is an interesting specimen in the Mütter Museum—a cast of the Siamese twins. The cast shows the lateral curvature of the twins, and the lateral curve is in an opposite direction, the shoulders toward each other being raised. The photograph, as they stand, demonstrates clearly that in order to give each more room they stood leaning away from each other. This demonstrates also the case reported by a French surgeon, where two twin sisters were obliged to sit on the same school-bench, and developed lateral curvature in opposite directions. It was found, on examination, that they were crowded from narrow seats, and in order to give each other more room they leaned on opposite elbows, producing, eventually, lateral curvature.

At Berlin, in the International Congress, this subject of the etiology of lateral curvature was discussed. Kirmisson, of Paris, presented the various theories concisely, and urged the acceptance of one factor often overlooked—viz., the lack of resistance of the osseous structure of parts of the spinal column to the superincumbent weight. The condition is analogous to that developing the knock-knee of adolescents—a condition such as has been mentioned by Dr. Ryan.

Dr. John Ridlon, of New York.—With reference to the subject of rickets bearing on lateral curvature, I have a patient in New York under treatment who has knock-knees and a similar deformity at the elbows—what we might call knock-elbows—who has lateral curvature, and who also had, before operation, cleft palate. In her case I fail to see that the lateral curvature has any bearing on the rhachitic condition, the arms, the legs, or the cleft palate. The child was imperfect when born, and there appears to be no more reason why one imperfection is dependent upon the other than the other is due to the first. I think we have gotten about as far in the etiology of lateral curvature as we shall get at this time, when we say we do not know what the cause is. Of course, there are cases that are unquestionably due to paralysis; there are others probably due to spasmodic contractions; and others to rhachitis. There are curvatures that appear after attacks of empyema, and there are cases due to superincumbent weight, and to habit, long-continued, like the Siamese twins; but the vast majority of cases which come to us must

be accounted for in some other way, or not at all, and it is that class of cases that we are trying to clear up in this discussion. The weight of writings on this subject seems to point to superincumbent weight, and to it alone, as the cause of a large number of cases. People, however, who have no lateral curvature have the same superincumbent weight as those who have curvatures. Moreover, certain persons are accustomed to carrying heavy burdens on their heads, and they are noted for their straightness. But here may come in the question of superincumbent weight when the spine is out of line. Take, for instance, men who carry kegs of beer all their lives, and very few of them have rotary lateral curvature, in spite of the fact that they carry the keg on one shoulder, and do not alternate shoulders.

Dr. Henry Ling Taylor, of New York.—We must distinguish, in discussing the causation of lateral curvature, between the predisposing causes and the efficient or exciting causes. The number of predisposing causes is great, and a good many of them were mentioned this morning. The same as in typhoid fever or phthisis, we know that age, sex, the general health, and a great many other things influence the predisposition, and before we knew the real exciting cause we may have thought that some one of these was an exciting cause; but when the specific microbes of these diseases were discovered, we found out the real exciting cause, which was perfectly definite, and it became evident that the predisposing causes were the conditions which favored their development. It seems to me that while we know a good deal about the predisposing causes of lateral curvature, we have not, as yet, got at the exciting cause, and the microbe of lateral curvature yet remains to be discovered Dr. Lee has made an attempt in this direction; but I agree with the last speaker (Dr. Ridlon) in thinking that there are a great many different causes—that different types of lateral curvature are caused by different exciting agents, and that in many cases there is a multiplicity of causes. Dr. Lee's theory, so ably expounded, is perhaps a possible explanation for certain cases. Dr. Ketch's investigations have shown that many cases of lateral curvature begin before the ovaries are functionally active; and to these Dr. Lee's hypothesis cannot apply.

In regard to the inequality in the length of the lower extremities, I have changed my opinion considerably as regards its efficiency as an exciting cause of lateral curvature. In most instances of crural asymmetry there is no scoliosis.

I have had within the last few months two cases. One case was a woman twenty-four years of age, who had more than two inches of shortening of the right leg without any lesion of the muscles, bones, or joints, and with no lateral curvature. The other case was a girl, fifteen years of age, in whom there was one inch shortening of the left leg, and no scoliosis; in both cases the short leg was the most muscular and the biggest. The subject of causation seems still open for discussion and investigation.

Dr. Samuel Ketch, of New York.—Allusion has several times been made in this debate to some investigations that I made some years ago concerning the etiology of lateral curvature, especially in young children. Dr. Lee, in his remarks, referred to these investigations. These cases were typical rotary lateral curvature, and did not include those caused by shortened legs, or lung trouble, or any of the extraneous causes, nor paralysis. They were especially selected for the purpose and the causes carefully investigated.

One of the objects of that paper was the investigation of puberty, and incidentally with that would come up the question of sexual growth and sexual function in the causation of lateral curvature. As has been stated, so many of the cases were found to have developed before the age of puberty, that puberty alone as a factor was thrown out of consideration as a cause.

Dr. Ryan has mentioned the subject of rickets as an etiological factor in rotary lateral curvature. I believe rhachitis has for many years—certainly since the researches of Eulenberg—occupied a position as a cause of lateral curvature. Eulenberg does not believe that all lateral curvatures are produced by rhachitis.

Dr. Ridlon has called attention to the fact that we are not to-day in a position to know accurately the causation of lateral curvature. I agree with him in a measure, but I certainly think many things have been placed on a surer basis during the last five years—isolated points it is true—but such, when taken together, will throw light on the etiology of lateral curvature.

In this connection I think there is one thing that has been left out, especially regarding the muscular element as a cause of lateral curvature. All of the papers I have heard have dealt exclusively with the extraneous muscles; that is, all of the long muscles of the spine have been dealt with, but no mention was made of the short intrinsic muscles which go from vertebra to vertebra. My idea is, that these are seriously affected in lateral curvature. Of course, it would be a difficult thing to demonstrate this by any electrical or other test we have, simply because we cannot get at them; but when we look at the rotation of a scoliotic spine it must be something more than the muscles going the whole length of the spine that are brought into action before we can get the divergence between the vertebræ. There is faulty action between adjoining vertebræ, but not among the vertebræ as a whole as we consider them.

There is another element which goes a great deal further back in the etiology of lateral curvature—those elements which have the functions of growth and repair under their special charge, and this I think lies in the central nervous system. I believe that the "microbe" of lateral curvature, as Dr. Taylor has aptly called it, will one day be found in the nervous and not in the bony or muscular system.

Dr. Reginald H. Sayre, of New York.—I will not occupy much of the time of the Association, but what Dr. Ketch has said coincides very nearly with the view which I hold in regard to lateral curvature, and I think what he says about the cause of it residing in the nervous system is very largely so. I think, also, that the rhachitic element is a very great factor in the production of lateral curvature. Rhachitis is not simply a disease of bones, but is a disease affecting the general system; it is largely a nervous disturbance. Rhachitis exists in a very much larger proportion of cases than is generally recognized; I believe it to be the cause primarily of lateral curvature; although the various influences of weight applied in an abnormal position to softened bones, and the various other well-known causes which have been mentioned, paralysis, etc., then come in as exciting causes. But I think no one can look at the various pathological specimens that are in our museums without being struck with the fact that a bone-change is one of the primal causes

of lateral curvature—of true scoliosis. This bone-change, I think, is secondary to those central nervous disturbances which Dr. Ketch speaks of. In the very early cases that I have seen in the first four or five years of life, before any particular dorsal rotation could be observed, when the child was bent forward, I have almost invariably found a deviation at the lumbo-sacral junction, as if it were a starting-point of a curve which was to develop later on. There had been a change in the lumbar vertebræ. The external appearance gave the impression of a softened and distorted lumbar vertebra similar in its character to the distortion you find in genu-valgum with the relaxation and contraction of ligaments which you find in these cases. I have felt in some cases that if I dared to go in there and loosen up the ligaments on one side of the spine, I would be starting in the right direction to remedy the primary curve which I could not reach in any other way.

I think what Dr. Ketch has said about paralysis affecting the intrinsic muscles of the spine is undoubtedly so. We all see these slight cases of anterior poliomyelitis affecting the leg. There is not much, if any, visible distortion, but we notice inequality in the gait, a little weakness which the patient cannot locate. He knows that one leg is not as serviceable as the other. His friends say there is a peculiarity in the child's locomotion. It requires a careful examination to determine just the extent of that lesion. If you examine it, you will find there is a trifling diminution in the power of the anterior tibial, for instance, of one leg. You will find, after close questioning, that the child has had fever or the history of infantile paralysis, months or years before, but recovered so completely that there is left behind only the slightest trace of mischief. When that condition occurs in the spinal muscles instead of the anterior tibial, for instance, it puts the spine in such a condition that the superincumbent weight falls on it in a faulty manner, though the lesion is too slight and too far in to be located electrically; and, with the more or less impaired nutrition of the parts supplied by the nerve affected by the anterior poliomyelitis, that portion of the spine is put in a favorable condition for the subsequent development of lateral curvature; and I think that, in many of the cases seen later on, the appearance is identical, whether the cause was originally paralysis, rickets, or something we do not understand.

I have seen a case of club-foot in a hysterical girl, shown by Dr. Shaffer some years ago. The case was only of six weeks' standing, and could be rectified by the hand. You could put the foot in a normal position, but as soon as you released your hold the girl would distort it again, and the distortion was similar to that which we find in those untreated cases of congenital equino-varus which, some gentlemen claim, cannot be removed without the excision of a large wedge-shaped piece of bone, showing the great effect of muscular spasm in the production of this deformity. Muscular contraction will produce similar deformities in cases of lateral curvature; then, after a period of years, if left in that position, you have absorption of the bone from pressure. If the girl with club-foot of whom I speak had held her foot in that position for a number of years, I have no doubt stretching of the ligaments on the outside and the contraction of ligaments on the inside of the foot would have given a person the impression that here was a case of congenital club-foot with distortion of bones from the outside. I have no doubt in those paralytic cases, or in the cases where, on account of some central nervous irritation there is spasm of some of the muscles of the spine, causing slight deviation, that subsequently there may be found the appearance of one of the idiopathic congenital cases.

I have seen a case of lateral curvature in the chicken—which was shown to me by Dr. White, of New York—a beautiful specimen of a condition exactly resembling lateral curvature as we see it in the human being. The rotation and the various distortions are reproduced very faithfully.

I think the various conditions which were mentioned this morning have a bearing upon the causation of lateral curvature, but I do not think we can put our finger upon one special thing and say this is the only cause of lateral curvature. I think, primarily, that there is this softened condition of the bones, due to defective nourishment on account of an impaired central nervous system, as a starting-point in the idiopathic cases; and, secondarily to that, there are the various influences of posture, unfavorable growth, of slight paresis of certain groups of muscles, and those influences which develop later on in life, as we know they do, and are due to the nerve irritation of which Dr. Lee spoke this morning.

Dr. Ketch.—I want to correct an impression which Dr. Sayre seems to have entertained, viz., that there was a paralysis of these intrinsic muscles. I did not intend to say that, and I believe I said it was difficult to demonstrate this condition of the muscles, as they were out of our reach. I fully recognize the cases due to infantile paralysis. But whatever the cause is, I believe it to be something connected with the nutrition of the intrinsic muscles, rather than paralysis.

Dr. Sayre.—In reply to Dr. Ketch, I did not refer to the cases of marked paralysis. I said that in many of the cases there is a curvature, and we do not know what it comes from. I believe that in many of these cases the cause which we do not understand is a slight weakening of some of the intrinsic muscles, similar to the little paresis we see in the leg, thigh, and arm, which we cannot demonstrate because, as Dr. Ketch has said, we cannot get at them to show that they are affected.

Dr. Ap Morgan Vance, of Louisville, Ky.—I wish to say a word or two in regard to the cause of lateral curvature. I think the trouble lies entirely in the bone. I cannot accept any muscular element in the causation—that is, a disproportion of the muscular strength on one side of the body; and with a large clinical experience in observing cases with various distortions about the spine, I recall many cases of people who thought they had lateral curvature when there was really no curvature present, but simply a disproportion in the muscular power upon one side, from the occupation they followed. I recall the case of a woman particularly, about twenty-five years of age, whose dressmaker said she had a crooked back. She came to the hospital to be treated. On close examination the spine was found straight. Upon inquiry she told me she had for years been a silk-winder; that she turned an ordinary wheel (like a spinning-wheel) with the right side of her body, while she inserted the thread with her left hand. The right side developed an inch and a half larger than the other. The whole body was developed more on the right side, still her spine was straight.

I believe the cause lies in a loss of mechanical symmetry of one or more of the vertebræ—probably in some cases, as Dr. Ryan has

remarked, from rickets, but I cannot accept that as a cause in all cases. We see strong women with lateral curvature, but with no sign of rhachitis. They cannot have rhachitis of the vertebræ and not have other evidences of it, and be as robust and strong as they are. I do not see why a disproportion in the bony structures of the vertebræ, one or more, cannot be caused by the arrest of osseous development. As I have said before, I believe the cause lies in the bone and a disproportion in the mechanical structure.

Dr. L. A. Weigel, of Rochester, N. Y.—I think this discussion has demonstrated that we cannot attribute scoliosis to any one cause; that there are a number of causes; and that they may vary in different cases.

Dr. Ryan spoke of patients being in good health generally. I can hardly agree with him. I should say that, in a fair proportion of cases, the general health is not good. They are not properly-nourished subjects; there is defective muscular development, and, in quite a few cases, greatly retarded sexual development. Menstruation is sometimes delayed for perhaps four, five, or six years beyond the usual time.

From the fact that we have cases that may justly be considered as congenital, it would seem that there is an imperfect development, due, perhaps, to an arrest of growth *in utero*. When we meet with scoliosis in a child a year old, it does not seem reasonable to consider it as having developed after birth, but rather that there must have been a congenital abnormal condition of the spinal column. Some years ago, Dornblüth, in his paper on "Scoliosis," gave some drawings from a dissection, in which there was found an actual difference in the height of the bodies of the vertebræ on the two sides. There was an arrest of development on one side. What the cause is, no one seems to know.

From the demonstration that Dr. Judson gave this morning, and the other remarks made, such a thing as a pure lateral curvature without rotation cannot exist, and yet such cases are referred to in some books.

With reference to the etiology of scoliosis, I am rather inclined to the opinion that in many cases there is, as a starting-point, an irri-

tation of some kind about the bone or intervertebral cartilages, and that the muscular element comes into play secondarily.

Dr. James K. Young, of Philadelphia.—I have nothing new to add to what has already been said of rotary lateral curvature. My own opinion is that any external cause which disturbs the equilibrium of the spine may be looked upon as a predisposing cause of lateral curvature. The secondary changes which occur—osseous, nervous changes—I look upon as atrophic, the result of this altered equilibrium of the spine.

Dr. J. Hendrie Lloyd, of Philadelphia.—I have not heard all of the discussion on this very interesting subject, which has been to my loss. It is possible that some of the members in their remarks have already referred to a certain condition of central nervous disease, which is known to produce this condition of lateral curvature. I refer to syringomyelia, which is a disease of the central portion of the cord, involving the trophic regions. The trophic disorders of syringomyelia are especially marked symptoms of it. It is undoubtedly a cause of lateral curvature.

Many theories have been advanced to explain the pathogeny of this scoliosis. Roth believed it is caused by atrophy of certain of the spinal muscles, due to degeneration in the cord. Morvan also claimed that lateral curvature is caused by a disturbance of central trophic innervation. This is probably the correct explanation. In some forms of dystrophy, as pseudo-hypertrophic degeneration, scoliosis is present. I have under my care now an example of this in a girl at the Home for Crippled Children. She has been bedridden for many years, so that the weight of her head and shoulders does not act as a cause.

Dr. G. G. Davis, of Philadelphia.—There is no doubt that if the supporting mechanism of the spine is weakened, then pressure will produce the deformities, rotary and lateral, and I think that spinal rotation is due pretty much to a condition analogous to that of flat-foot, and that it is primarily a change in nutrition. Of course, the nutrition is affected in rickets, but I believe rickets to be essentially a disease of childhood, and if we have no lateral curvature occurring

until many years after rickets shows itself, then I take it that the affection is removed from the domain of rickets and it becomes another disease. Lateral curvature can, of course, occur in rhachitic children, but in rhachitis the curvature is more apt to be simply an antero-posterior one, embracing the larger portion of the spine, and the lateral curvature is not at all marked—at all events, it is not the curvature to which reference has been made to-day. The curvatures which have been discussed are largely or principally those which occur in youth, and I believe that they are due to a nervous or trophic cause, and occur in any patient whose muscular system is impaired; that in rapidly-growing individuals, approaching or at about the age of puberty, there is a general weakness of all the tissues of the body; there is relaxation of the ligaments. Youth is noted for its frailty; the ligaments are not strong, neither are the muscles as strong as they are when a person has grown to maturity, and the bones, also undergoing rapid changes, all combine to make deformities without any special exciting causes presenting themselves. I do not believe the disease starts in the bones, but that the disease in the bones is secondary to other causes—that is to say, in a weakened spine if you have pressure you will have secondary changes. I think it is rather far-fetched to say that it may be an osseous affection attacking one of the vertebræ and growing upward, and thus disturbing the spine. I would rather look upon the osseous changes as secondary, in the same way that when you once have ligamentous and muscular weakness, leaving the arch of the foot down, why then you have osseous prominences at the head of the astragalus and of the scaphoid bones showing themselves.

Dr. Benjamin Lee, of Philadelphia.—I wish first to thank Dr. Ketch for correcting a suspicion which I expressed as regards the character of the statistics which he brought before us. I would like, however, to be also certain as to the equal pertinence of the statistics of Eulenberg and others which were adduced by Dr. Lovett or Dr. Scudder. I think these gentlemen are not present. I do not see them. Perhaps Dr. Ketch can tell us whether in these statistics, also, evident causes, such as rhachitis and others to which I have alluded, had been excluded, and whether the cases upon which the results were based were simply those of lateral curvature, which

I consider to be a distinct disease—not rhachitis, not osteomalacia, and not in any way dependent upon bone changes. In all the years which have elapsed during which this disease has been studied by so many careful observers, if there was a degenerative bone change which caused lateral curvature, that bone change ought to have been demonstrated. It has never been so demonstrated, and I do not believe, therefore, that original bone change has anything to do with it. The general condition of the large majority of patients is not in the least such as we find in cases of rhachitis or osteomalacia. As Dr. Ryan well said, we find the disease quite as often in extremely robust patients as we do in those who exhibit enfeeblement of constitution of any kind. Certainly the characteristic lesions and symptoms of rhachitis are absent. Rhachitis comes on at an earlier stage than we usually find lateral curvature developing, the majority of cases of rickets beginning in early infancy, and we are all familiar with the extremely characteristic symptoms of the disease. These symptoms do not form a part of the history of rotary lateral curvature as I meet with it.

The other probable causes which have been alluded to, such as weight and habit, come in perfectly naturally as secondary causes, but they leave to be indicated an initial cause which enables them to act.

I quite agree with Dr. Ketch in attributing great importance to the action of the erector spinæ muscles, the intrinsic muscles of the spine, but I attribute importance to them as establishing the secondary and not the primary curve; they are intimately connected with the equilibrium of the spine, and the moment any cause disturbs that equilibrium they are on the watch to restore it; but my own belief is that they act secondarily, and not primarily. If superincumbent weight were the cause, I do not see how any of us could escape lateral curvature. We all of us carry heads on our shoulders. Some of them are light heads, it is true [laughter]—I admit there is a difference in this respect. The very object of the spine is to support weight; that is what it was made for. And as has been well said already by one of the speakers, those who habitually carry the heaviest weights on their heads have the straightest spines. I do not see, therefore, how weight can have much influence as the initial cause; it comes in, as other influences do, secondarily.

Great stress has been laid in the books on tight lacing. If Dr. Ketch's statistics are to be relied upon, the majority of cases begin before the corset is put on a child. Importance has also been attributed to the attitude of girls at school. This is exactly the same as the attitude of the boy, yet in nine-tenths of the cases the girls develop lateral curvature and the boys do not.

So that we must go back to some defective condition residing in the female sex as the initiative. The disproportion is altogether too great to permit us to throw out that consideration; and as the pelvic spinal muscles are acknowledged to establish the normal curves of the spine, acting normally and symmetrically, it seems plausible to suppose that, in very many cases, their abnormal and asymmetrical action may account for the abnormal curves.

Dr. A. B. Judson, of New York.—I have one question to propose, addressed more especially to those who have expressed belief in the muscular spasmodic theory of the causation of lateral curvature. I would like to ask if they think a person who always occupies a recumbent position could acquire lateral curvature?

Dr. Sayre.—I am one of the gentlemen that Dr. Judson refers to. I can conceive of a patient all the time in a recumbent position developing lateral curvature. I would not call it one of the ordinary lateral curvatures we meet with every day. I can see no reason why a patient may not have a spastic condition of the spinal muscles due to a brain lesion which would distort his spine, even though the patient were kept in a perfectly recumbent posture.

Dr. Ridlon.—I have such a case that I wish to put or record. A girl, fifteen or sixteen years of age, was taken with typhoid fever. She had a careful, watchful mother, and a very careful medical attendant. No lateral curvature was suspected or noticed by them, although she had been accustomed to wear close-fitting waists. While lying in bed with this disease she developed a characteristic rotary lateral curvature. I am one of the ignorant ones; I do not know what caused her lateral curvature. This, I believe, answers Dr. Judson's question.

Dr. Davis has spoken of flat feet in connection with lateral cur-

vature. I wish to call attention to a fact that we are all more or less familiar with, namely, Roth's claim that almost all cases of lateral curvature have flat feet. For three years I have watched carefully all my cases of lateral curvature to learn if they had flat feet. Not finding this true as to American girls, during my visit in London this summer I carefully looked at the feet of some thirty girls under his care, and in none of them did I find what in my judgment could be termed flat-foot, although they were recorded by him as having it. None appeared to have more flat-foot than can be found in ballet-dancers who are able to stand for long periods on their toes. No convincing evidence has been adduced to show that the same condition causes both lateral curvature and flat-foot.

Dr. Ketch.—I am afraid the ideas expressed regarding the nervous or neural element in the etiology of lateral curvature have not been understood. I think a wrong conception has been expressed of what I meant—owing, it may be, to the way in which I stated it. I did not speak of any disease of the nervous system as being the cause of lateral curvature. I spoke of the cause which goes further back, and to which all other things are secondary, viz., lack of equilibrium, fault in the centres of development—of those that preside over the functions of nutrition, especially in the nervous system.

I am very happy that one gentleman, whose name I cannot at present recall, has brought out a clinical fact which bears strongly on the question of a disturbance of the central nervous system as being a factor in the etiology of lateral curvature.

Another thing I would like to mention. In the paper I read, which has been extensively quoted in this discussion, I distinctly spoke of *typical* lateral curvature, not dependent upon any causes, such as rhachitis, empyæma or lung trouble, shortened leg or other things. Regarding the statistics of Eulenberg, I do not take upon myself to speak of them as being compiled in the same manner. If Dr. Lee will look at Hueter he will find that Eulenberg has given separate consideration to rhachitic cases.

The main object I had in getting up was to raise my voice against simply accepting the fact that because we have not as yet very definite views regarding the etiology of lateral curvature, we had

better let it rest. My idea is: no matter how slightly they would bear upon the question of etiology, such causes would be of value; and eventually, if we gather all the facts, we can perhaps have a legitimate cause of typical, or, as Dr. Lee prefers to call it, idiopathic lateral curvature.

Dr. Vance.—I was interested in Dr. Ridlon's case of typhoid fever in which lateral curvature developed, and also the remarks made by Dr. Davis, that rhachitis may be the cause of it. I do not think the mother's statement that there was no lateral curvature can be taken as a fact. We have seen patients come into our offices with other troubles, with Pott's disease, who never knew they had these troubles or distortion of the spine. The statement of a girl coming into a surgeon's office and giving a history of no spinal trouble until a few months ago, cannot be relied upon as much as if we had seen the case ourselves and had examined it carefully. I do not think we ought to accept as scientific the statement of the mother —or even the family physician who had not examined the case carefully.

Dr. Ryan.—I have but a few words to say. In my opening remarks I thought I would say something which would stir up the members of the Association a little, and I find I have been misunderstood in a measure. My remarks bore on rhachitis more than any other factor. I did not mean to have the Association infer that rickets was the cause of the majority of cases of lateral curvature. I think it is one of the causes which is estimated much less than it deserves.

One gentleman, in speaking of rhachitis, says it is a disease of childhood, which is true; that the curvature of the spine which we find in rhachitis was antero-posterior, which is also true. Those of us who have seen a great many rhachitic children know that it occurs sometimes in patients as old as six years, and that it may be very marked. The cases of lateral curvature that were rhachitic were cases of rickets developed in infancy; there was some osseous change during the rhachitic period, this change becoming the efficient cause. The determining cause is altogether a different matter.

It may possibly be a nervous or muscular one, but the primary change was a rhachitic one.

Dr. Ketch's remarks, I think, were made in the right spirit. It is true, we do not know the true cause of lateral curvature; we do not know the causes of a great many other affections, but that does not prevent us from pursuing our investigations and trying to find them. It occurs to me, it is the things we do not know that we should discuss most.

The point that men carry kegs of beer on their shoulders does not seem to me to have a distinct bearing on this subject, because these men are matured, and lateral curvature does not develop after the figure or body has matured. It is the children who are maturing, who are stepping on the threshhold of womanhood and manhood, that have lateral curvature.

I think one of the gentlemen who spoke on the subject from a neurological standpoint contributed a fact; few of us have seen cases due to paralysis in which there was a distinct organic lesion of the cord. The idea that there is a condition analogous to that of infantile paralysis about the small muscles of the spine, is ingenious and somewhat curious, but I doubt if it will ever be proven.

Just one word about the general condition of the patients. My friend, Dr. Weigel, misunderstood me. I spoke of the incipient cases, the cases we see at first. The girls I see in private practice are usually in excellent health. They are out of doors a great deal; they play tennis. I did not speak of the old cases—the disease breaking them down and making neurotics out of them—but the majority of cases I see in private practice are in good health.

DEMONSTRATION ON THE TREATMENT OF CLUB-FOOT.

By THOMAS G. MORTON, M.D.,
PHILADELPHIA.

Dr. Morton made some remarks upon the pathology of the affection, and presented eleven cases upon whom he had operated by this method, with entire correction of the deformity.

Dr. Morton said that he considered congenital club-foot as arising, either immediately or remotely, from intra-uterine paralysis. He regards it as a form of infantile palsy. As the result of the spinal lesion, there subsequently occurs in every case of club-foot, of the congenital variety at least, more or less atrophy of one or more groups of muscles. This affects also the blood-supply, and the entire limb usually presents well-marked evidences of defective circulation. Not only are the soft parts defective in their development, but the bones also, in most cases, are smaller than normal, and in consequence the affected limbs are shorter than they should be. With regard to double club-foot, he holds that the nerve-lesion has been a more serious one, and this is seen in the defective development of the limbs, which are markedly spindle-shaped. The paralysis incident to these nerve-lesions is never entirely recovered from, no matter what method of treatment is adopted.

As explaining the different forms and grades of club-foot, Dr. Morton believed that the amount of the deformity is proportioned not simply to the extent of the nerve-lesion, but more especially to the time of its occurrence. For instance, paralysis occurring in the fœtus subsequent to the ossification of the tarsal bones, or shortly before birth, would not involve displacement of the tarsus; but if the paralyzing lesion occurred prior to ossification, or at an earlier stage of development, it would permit changes in the growing tarsus in accordance with the amount of contraction of certain muscles and the relaxation of their opponents.

The form of club-foot, almost without exception, which is found at birth, is equino-varus. Congenital calcaneus, or valgus, is not found at this time, unless associated with a more marked form of paralysis. Just why varus, and equino-varus, should be so frequent, and calcaneus and valgus so unusual, has not been satisfactorily determined; it is a fact, however, that when the latter forms of talipes are found at birth, there is associated with them a far more serious general palsy of the limb.

Clinically, Dr. Morton has found it convenient to recognize only two forms of equino-varus—(1) the uncomplicated, and (2) the complicated. In each case, before instituting treatment, the diagnosis must be made between these two groups. In the uncomplicated cases the tarsus is normal in shape, the deformity being confined to the soft tissues exclusively, or nearly so. The foot can be brought, by exercising more or less force, temporarily, into a position at a right angle or even an acute angle with the line of the leg, and the varus can similarly be overcome by force, so that the foot for the time assumes normal relations to the tibia and fibula. When this state of affairs exists, a cure can be effected by massage, traction, the use of orthopedic apparatus, and, when the child is ready to walk, tenotomy, especially of the tendo-Achillis. Dr. Morton opposes tendon-section early in life before the child is able to stand or walk.

In the second, or complicated group of congenital varus, or equino-varus, the tarsus will be found to present serious anatomical changes, not only in the shape of the bones, but in their position and relations to each other and to the leg bones. As already stated, this is the result of lesions early in intra-uterine life. By the contraction of the calf-muscles the heel is drawn upward and backward, and, pressure being made upon the astragalus by the tibia, this bone is pushed forward and more or less rotated upon itself. This occurs sometimes to such an extent that Dr. Morton found, in some of the patients now exhibited, that the tibia did not rest upon the astragalus at all, but upon the os calcis, where a kind of ankle-joint had been established. When the astragalus is thus malformed and displaced, it forms a wedge in front of the joint, effectually blocking flexion of the foot upon the leg.

The displaced astragalus can always be recognized by the ab-

normal prominence upon the dorsum of the foot; there is an irregular, arched projection, just in front of the fibula. It may be also noticed that the tibia and fibula are placed more posteriorly than usual (or that the heel is short). In some instances, in which Dr. Morton had excised the astragalus, this bone had absolutely no relation whatever with the tibia, which rested upon the os calcis.

In all such "complicated" cases, Dr. Morton advises the removal of the astragalus. In support and demonstration of his views, he presented eleven cases treated by him after this method for the relief of congenital equino-varus. The advantages of this operation, to which he particularly desired to call the attention of the Fellows, are as follows:

1. The resulting freedom of ankle motion.
2. Immediate and permanent correction of the deformity.
3. In the after-treatment no brace or severe manipulation is required.
4. There is no possibility of a recurrence of the deformity to its former degree.
5. The operation is not difficult and is free from danger when performed antiseptically.

Concerning the technique of the operation of excision of the astragalus in these cases in which it is more or less dislocated, he said that it presented no difficulty. The following steps of the operation were mentioned: The limb is first emptied of blood by a rubber bandage, and thoroughly cleansed with soap, bichloride solution and ether. The astragalus, being simply subcutaneous, is exposed by the single straight or slightly curvilinear incision, extending from the level of the external malleolus along the dorsum of the foot to near the base of the fourth toe. The peronei tendons, if necessary, are held aside. A stout bistoury, or small amputating-knife, is then used to separate the attachments of the bone, which is held in the grasp of the bone-forceps until liberated. As the final step of the operation, the tendo-Achillis should be divided. The wound is drained by a few strands of catgut ligature, and the wound brought together with the interrupted suture of the same material. After the usual antiseptic dressing is applied, the extremity is placed in a well-padded, right-angled tin splint, having an opening opposite the heel. Care is to be taken that the heel is well down and the

sole of the foot properly adjusted to the splint. The dressings (which should leave the toes exposed), need not ordinarily be disturbed for several weeks. After this, or as soon as the wound is firm (which will be the case in six weeks or even less) the child should be encouraged to use the foot in walking; no brace is required, simply a well-fitting shoe. Bearing in mind the fact already referred to, that the club-foot limb is always a short limb, the heel of the shoe must be raised sufficiently to make up the deficiency, or want of symmetry.

Dr. Morton, in concluding, stated that he believed that the old tarsotomy, tarsectomy, and the open incision, will seldom, if ever, be required in the treatment of club-foot, unless it should be in those inveterate deformities seen in adult life, as the result of entire neglect of treatment, or of unsuccessful operations done early in life which were either inefficient or not properly carried out.

NOTE.—With regard to one of Dr. Morton's cases, Dr. Hunt, of the Pennsylvania Hospital, furnishes the following report:

"PHILADELPHIA, October 16, 1890.

"To-day I was present at an operation for the removal of both astragali from the feet of a boy of about eleven years old, for intractable club-foot when treated by ordinary methods. The operator was Dr. Thomas G. Morton; Professor W. S. Forbes was also present. Dr. Morton was particularly desirous of the presence of Dr. Forbes and myself, as the necessity for this apparently serious operation has been questioned. I had seen it performed on very young children with favorable results, but as the displaced bones had nothing about them recognizable as astragali, I was anxious to have an older patient to examine, in order to observe the effects of development in the abnormal position. That there was nothing normal recognizable in the cases of the young infants I speak of, is proved by the fact that on one occasion both bones were removed and were sent to that profound anatomist, Dr. Joseph Leidy. He did not know them, or even whether they were human. This is important as bearing upon the fact of regarding them surgically, in these cases, as foreign bodies.

"In the case of the patient to-day, the deformity characteristic of a displaced and abnormal astragalus was particularly noticeable in both feet. In front of the *external* malleolus there was a marked projection more than one-half an inch in diameter, which, when covered by the skin, seemed both to sight and touch like the head of some displaced bone. The normal depression across the natural foot at this place was wanting, and the projecting bone made full flexion impossible. There were the usual callosities of the foot of active boys of this age who have been afflicted with club-foot from birth.

"The boy was etherized and the bones were removed through one long incision in each foot. The Achillis tendons were divided, and in one foot it was necessary to divide the plantar fascia subcutaneously. The wounds were sutured and the feet were easily brought into the right-angled position and secured upon tin splints.

"The removed bones were now examined. As in the young infant, there was little resemblance to normal bones, but there was enough to recognize what they were. Description of one of them is sufficient: In the first place, it was abnormally long, and much the greater portion of it was in front of its true position. It was bent upon itself, and, as it were, partially rotated inward. The bending was across the body of the bone, and the above-mentioned peculiar projection in front of the external malleolus was the anterior lateral portion of the external face of the astragalus, which is normally marked by the articulating facet for the external malleolus. The true articulating facet was only partially formed. The neck and head of the bone projected obliquely across the foot from without inward. The bone seemed to have no support from the sustentaculum tali, but, as the object was to save the foot, this could not be ascertained positively; nor could the effect of the displaced bone upon the rest of the tarsus, for the same reason, be looked into. Sufficient, however, was found to demonstrate that, in this class of cases of club-foot, the astragalus is not only useless, but very harmful. It is practically a foreign body, and should therefore be removed. Without its removal, the sole of the foot cannot be brought to the ground, because the foot cannot be flexed to a right angle, as the displaced bone is a complete chock to the joint.

(Signed) "WILLIAM HUNT."

Professor William S. Forbes also contributes a note with regard to this case:

"The astragalus was displaced outward and forward, its long axis diagonally across the external dorsal aspect of the foot; its internal posterior margin was placed in front of, and articulated with, the external malleolus (the fibula). The os calcis, the long axis of which is normally quite in accord with the long axis of the foot, had its long axis thrown from behind forward and outward and nearly at a right angle with the astragalus, as the latter was found as stated above. The outer margin of the whole foot was turned inward; the plantar aspect of the whole foot faced the foot on the opposite side.

"In the production of this astragalus displacement, all of the flexor muscles have been more or less involved, the flexor communis the least so."

TREATMENT OF LATERAL CURVATURE.

By E. H. BRADFORD, M.D.,
BOSTON, MASS.

Anyone who has paid attention to the subject will have observed that much misconception exists in the mind of the medical community in regard to the distortion called lateral curvature. This is partly due to the difficulties of the problems of scoliosis, and partly to the inadequacy of the literature.

When considering the subject of treatment, it is necessary first to bear in mind the etiology of the deformity—the proper basis of all treatment. Although the subject is by no means clearly understood, it is now quite generally accepted as a fact that the distortion is due to the yielding of the bones and ligaments of a spinal column less resistant and strong than normal, under the superincumbent weight falling upon a spine held in a faulty attitude—that is, leaning somewhat to one side. As the distortion of knock-knee is due to the yielding of the bone and ligaments, so the spinal column yields and the individual vertebræ shape themselves according to the altered pressure.

An opinion quite common in the general medical profession is to the effect that lateral curvature is in some way due to an inequality of the strength of the muscles of the different sides of the body, the result twisting the trunk. This opinion has given rise to a system of treatment which at one time largely ruled the medical world, and which is still to be regarded as of value, although the basis on which it rests is no longer entirely accepted.

This theory, though a prevalent one, is not strictly true, for lateral curvature is not due directly to an inequality in the strength of the muscles of the different sides, any more than genu valgum is due to the strength of the outer hamstring as compared to the inner

hamstring muscle. Muscular weakness, however, giving rise to a faulty attitude and unequal pressure on bones lacking normal resistance, may cause distortion at the knee and of the spinal column. In the same way, inequality in the length of limbs, peculiarities of attitude from occupation, improper school seats, faulty chairs (favoring, as they do, unequal pressure in parts of the spinal column), may cause the distortion of lateral curvature in spinal columns which happen to be less resistant than normal.

The gymnastic system of treatment can necessarily not be regarded as adequate in treating all phases of scoliosis, for it can only be used to strengthen certain sets of muscles, and can in no way prevent the superincumbent pressure or correct fixed curves, or employ any correcting force by pressure. In the same way gymnastics are of value in strengthening the muscles of a limb where a faulty attitude threatens to cause knock-knee; but gymnastics would be nearly, if not entirely, useless when there is a marked change in the shape of the bone.

If the results of gymnastics are not all that can be desired in the severer cases, the same may be said of the treatment by spinal couches, which formerly were so much in vogue in the Continental orthopedic institutes. They are not curative in the severest cases, and are impracticable in the lighter cases where they would be of benefit, for the reason that, as a rule, patients with slight curves will not submit to such radical treatment, either at all or for the requisite length of time.

The results following the treatment by mechanical appliances alone cannot be said to have been altogether satisfactory, if the object of such appliances has been to correct well-marked fixed curvatures. Appliances which are efficient are cumbersome and uncomfortable. To be of use it is necessary to wear them a long time, often several years. Patients and parents object to their use for any length of time in lighter cases, and in the severest cases no correcting appliance will be found able to correct at all unless the superincumbent weight is removed.

It is for this reason that the heavier correcting appliances described by the older orthopedic surgeons and formerly used, have fallen into disrepute and are at present discarded.

The introduction of the treatment by means of plaster jackets was

in itself a radical innovation, and it was at first thought that the riddle of the proper treatment of scoliosis was at last solved, but experience has not confirmed such a supposition. In fact, a surgeon whose attention is called to the treatment of this distortion frequently meets a large number of patients for whom little or nothing can be done; and, if he is honest with himself, often is obliged to face the question whether there is any rational and practical method of treatment of scoliosis. And I think frankness will compel him to admit that in many instances treatment has been of little, if any, benefit, and certainly that the use of any exclusive method, mechanical, gymnastic, or postural, is irrational and unsatisfactory, but that the individual cases need to be examined individually and treated in a variety of ways, according to circumstances, the state and extent of the curvatures; and that in many instances—*i. e.*, in the severer cases—all that he can attempt to do is to prevent an increase of the curve, and that absolute correction of the curve is impracticable or impossible. He also will find that he should not limit himself to the employment exclusively of any methods of treatment.

That there must be a rational and proper means of treating scoliosis is evident, and, like all treatment, it has its limitations. The treatment in scoliosis may be defined as consisting of the correction of flexible curves, the prevention of the establishment of bone changes in these cases, and, in osseous curvatures, the limitation of the curves, preventing an increase or relieving the symptoms in the severest forms.

Beside the modes of treatment already mentioned which have been before the profession for a long time, there are two methods which, though not entirely new, have recently been modified, and present subjects for the careful consideration of those of the profession who interest themselves in scoliosis. They may be called—

1. The postural method.
2. The method of forcible correction.

Postural Method.

Of the so-called postural method of treatment much has been written by Bernard Roth, Reginald Sayre, and others, and little will

be said here except to add that a method of this sort must form a basis for all methods of treatment.

The exercises recommended are practicable and simple, and have been well described by Bernard Roth and Dr. Sayre. They are based upon the method of Ling, but are reduced to a simplicity which has added much to its value, for it is essential that a drill in correct attitude in these cases should be carried out during the period of most rapid growth, and that means that it should be continued for several years, in many cases, if it is to be thorough. It is important, therefore, that there be such exercises as can be conducted independently, not only of gymnasia, but also, after a while, even of trained nurses. The patients should, during what may be termed the convalescent stage, be taught to rely on home supervision, with occasional direction.

Forcible Correction.

The use of force in these cases has naturally suggested itself to many surgeons, but Lorenz. of Vienna, has recently formulated a rational method of treatment where the employment of some force is an important factor, and Barwell, Hoffa, and Redard have also written upon the same subject.

It is manifest that in many cases simple gymnastic exercises are not sufficient to stretch the contracted ligaments, fascia or muscle, and until these are stretched it is impossible that an improved position can be assumed.

The question arises whether it is possible to stretch any contractions holding the spinal column in cases of this sort. It is manifest that in the severest types of cases this is impossible.

Though the method of violent correction, under an anæsthetic, has been suggested, it is manifestly impracticable in the lighter cases and useless in the severer cases; but Lorenz has shown that much may be gained by the daily application of properly applied force, pushed to a greater degree than has hitherto been the practice.

The daily use of self-suspension is an attempt in this direction, but the curvatures can be affected more readily in other ways. Of these there are several; the two which the writer has found most practicable are modifications of the arrangement of that used by Lorenz and Beely.

This method can be made a painful one if extreme force is used, or it can be graduated so that at first but little strain is used, but the amount can daily be increased as the patient becomes accustomed to it.

The appliances used by Lorenz and Beely are well known and need no further description.

A simpler method is that by which the superincumbent weight is entirely removed by the recumbent position.

The patient lies upon a board, attached at one end of which is a firmly-padded "roller," eight inches high. On this the patient rests the left shoulder (if the curve is the ordinary one), pressure is made upon the projecting ribs by means of a padded wooden bar, fastened to the board at one end, the other (the long arm of the lever) serving as a handle for the surgeon exercising pressure.

Fig. 1.

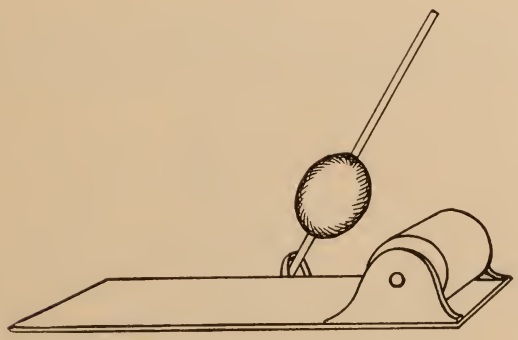


Fig. 2.

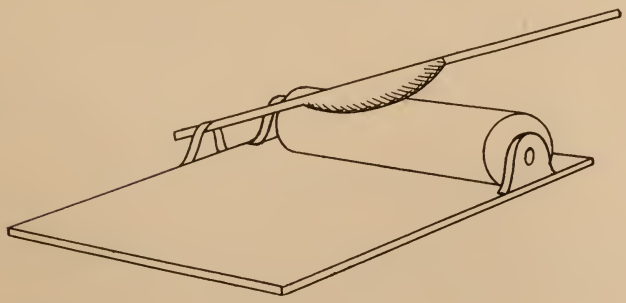
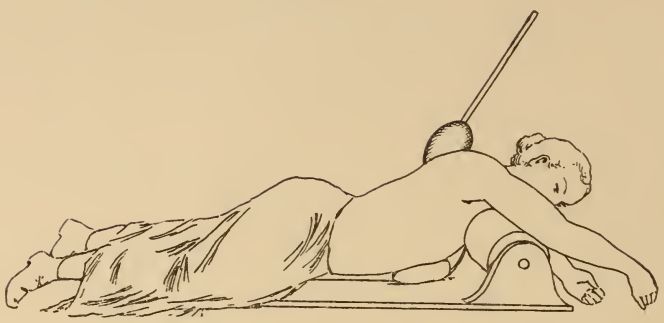


Fig. 3.



A firm pad placed under the projecting ribs of the left side will afford counter-pressure in that direction.

The "roller" can be used for stretching the antero-posterior curves of the spine, and as a means for the "prone" position during recumbency.

Forcible correction can also be applied by means of what has been termed lateral traction. The patient is suspended to remove

Fig. 4.

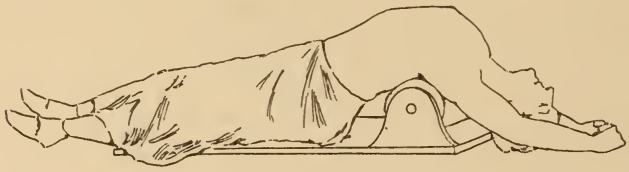
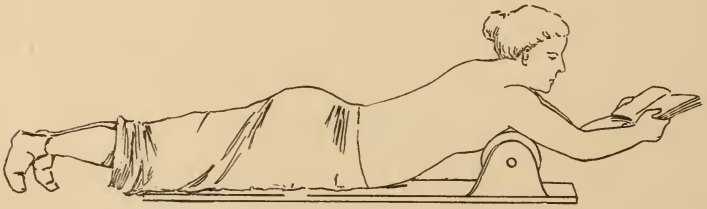


Fig. 5.



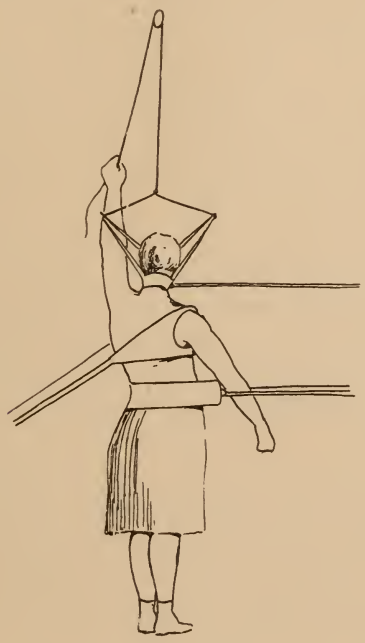
the superincumbent weight, and a lateral pull applied by means of straps, as the curve may indicate.

The method has been advocated by Barwell and Lorenz. The

latter has devised, but I think not yet published, a most excellent method by which self-rectification by lateral traction is possible.

Hoffa has also recommended a means of lateral traction, but I have as yet had no personal experience with the arrangement described by the latter two.

Fig. 6.



In addition to these, simpler means can be used, by placing the patient upon the floor or a hard lounge, raising the shoulder or hip by placing underneath a cushion, and exerting strong manual pressure or pressure by the knee or foot. The amount of this pressure exerted in this way does not equal that exercised by the mechanical means already indicated.

These exercises can be conducted daily with the simple object of increasing the flexibility of the spine, enabling the patient to assume voluntarily a corrected position, to be maintained by thorough treatment by the postural mothod; or, for a while, a fixed appliance or corset can be used, obliging the patient to maintain always a corrected position.

Means for this purpose are necessarily somewhat imperfect: the most efficient is an irremovable plaster jacket applied to the trunk corrected by suspension and lateral traction.

The jacket can, in a measure, be kept from slipping by means of perineal straps, or straps connected with the stockings and with buckles inserted into the jacket. The jacket can be applied to the patient (whose column has been made as flexible as possible), held in as corrected a position as possible, as in Fig. 6.

A removable plaster corset, a leather corset, one of stiffened felt, of wood-pulp, woven wire, are less efficient means of retention than an irremovable plaster corset: but they have a great advantage in that they allow gymnastic exercises, which are essential to the future maintenance of a correct attitude. A fixed corset can in lateral curvature only be used a portion of the time; how long it can be used will depend upon the nature of the case, the imminence of the danger of an increase of osseous change, and the absence of the danger from a weakening of the muscles of the trunk, for the fixed corset, which is the most efficient means of preventing or checking an imminent osseous change, necessarily, by disuse, causes some muscular weakness.

Of the steel appliances that are so numerous, the writer has been accustomed to favor the simplest, and with the object, not of attempting to correct the curve, but to check faulty attitudes.

The writer has discarded the use of the heavier appliance recommended by the earlier English surgeons, but he has thought that in certain cases, even of the lighter sort, a reliance solely upon the method of gymnastics is not always satisfactory, as gymnastics necessarily can fill but a small portion of the time, and the gain of a half-hour may be neutralized by hours of faulty attitudes.

It must be clearly understood that there is no royal road in the treatment of lateral curvature, and that gain is only accomplished, even in the lighter cases, by persistent treatment carried out for a long time, and that in many cases no treatment is feasible on account of the lack of thoroughness on the part of the patient; and in the severer cases treatment should be directed toward preventing an increase of the curvature.

In no affection is it necessary to distinguish more carefully indi-

vidual cases in advising treatment, and it will be found convenient to classify cases according to the stage and extent of the curve.

Besides the classification which readily suggests itself of right convex dorsal curves, left convex lumbar curves, which readily suggest themselves and of importance mechanically, for clinical reasons it will be found desirable to group individual cases as follows:

Cases in the initial stage, first stage.

Cases in the stage of development, second stage.

Cases in the stage of arrest, third stage.

Scoliosis has stages as other deformities have, and develops finally into a period where an arrest takes place. The treatment necessary in the earlier stage is necessarily different from that required in the latest stage.

A determination of the stage is based upon the manifest progress already made in the establishment of the deformity.

In the initial or first stage the curve is a flexible one, but little or no change has taken place in the shape of the vertebræ and no contraction of the intervertebral ligaments has been established.

The curvature entirely disappears when the superincumbent weight is removed, either by suspending the patient or when the patient is recumbent.

It is important to determine whether the curvature is the result of faulty habitual attitudes, consequent on improper chairs, school desks, or to the feebleness of certain groups of muscles.

This is to be determined by an examination of the strength of the muscles by means of a dynamometer as devised by Dr. Scudder, and also by a careful observation of the attitudes habitually taken—the chairs commonly used.

If the muscles are found weak, certain prescribed gymnastics are indicated. If the muscles are of average strength, and the curvature evidently due to a faulty attitude resulting from occupation—imperfect school chairs or desks, sitting or standing improperly—treatment by daily drill is desirable as well as the avoidance of the faulty occupation, if possible, or the limitation of the time when the faulty attitude is possible, and by the selection of suitable chairs and school desks.

Appliances are rarely needed at this stage, although in some instances I have advised retention straps or light appliances.

Where the patient is unusually weak or overgrown (as determined by Bowditch's table), enforced recumbency for a certain number of hours of the day is advisable, to rest the muscles of the back.

Constitutional treatment may or may not be necessary, according to the condition of the individual case.

Arrest of the curvature is established when all possible alteration in the shape of the bones has taken place, and when the vertebræ are sufficiently strong to sustain the superincumbent weight without yielding laterally or in the direction of torsion.

Roughly it may be said that a curve cannot be regarded as having reached the stage of arrest until ossification has been completely established. But there are exceptions to this rule; in severe cases curvatures will be found in some instances to increase, even in adult life.

These instances are, however, rare. On the other hand, there are cases (and they are not very uncommon) where curvatures which have been formed in early childhood remain unchanged during life, the ossification and growth of bone proceeding as the weight of the trunk increases, and developing sufficient strength in the bone to prevent an increase of the curve, but not occurring so as to correct the curve spontaneously, which has never been observed.

In short, a determination of the stage of arrest is a matter of judgment which will be correct according to the experience and accuracy of observation of the surgeon. No treatment in the stage of arrest is needed ordinarily. In severe curves, however, treatment will be needed to alleviate the symptoms. Stiffened corset, light appliances, recumbency, self-suspension, massage, will sometimes be found of assistance as means of alleviating the distress and discomfort caused by the superincumbent weight falling abnormally and unequally.

The patients in this stage which suffer the most are neurasthenic cases, whose excited nervous irritability makes them particularly susceptible to the irritation to the nerves caused by abnormal pressure and tension of fasciæ.

In these cases recumbency, massage, and electricity will be found of assistance.

The treatment of lateral curvature can be briefly formulated as follows:

Treatment of the first stage:

Postural treatment. Thorough drill daily in correct attitude and motion; proper gymnastics in the muscularly weak cases. Recumbency in the feeble cases, supervision as to chairs, occupation, and attitude.

Treatment in the second stage:

Treatment in the lighter cases similar to those in the first stage. Treatment in the severer cases the same, but with the addition of methods of correction and retention appliances.

Treatment in the third stage:

Generally no treatment. In severer cases corsets, self-suspension exercises.

It may be said that there are no brilliant results in treating lateral curvatures. Cases can only be relieved by persistent and painstaking effort, and rapid cures are not to be expected.

They are eminently cases which make a demand on the sense of duty of a conscientious surgeon.

THE TREATMENT OF LATERAL CURVATURE.

By HENRY LING TAYLOR, M.D.,
NEW YORK.

In spite of untold labor devoted to the subject of lateral curvature by able men we still seem to lack, for the ordinary forms of this affection, a scientifically-observed and well-digested clinical history, a satisfactory theory of pathogeny, and a thoroughly rational treatment.

There are, no doubt, diversity, multiplicity, and complexity of causation in these cases, but the theories so far advanced either fail to explain or conflict with observed facts, such as the following:

1. Most delicate children with weak spinal muscles, leading a sedentary, precocious, and intense life, and habitually assuming faulty attitudes, do not develop lateral curvature.

2. Some vigorous children, leading an active, open-air life, and whose spinal muscles seem as strong as, or stronger than, the average, do develop lateral curvature.

3. Right-handed people sometimes develop scoliosis with the dorsal convexity to the left.

4. Most children with considerable differences in the length of the lower extremities, and consequent pelvic obliquity, do not develop a rotary lateral curvature.

5. A patient with shortness of the right leg (without joint or muscle trouble) and pelvis sloping to the right may develop a curve with convexity to the left in the lumbar region.

6. Lateral curvature, with extreme rotation, may develop with the spine in the horizontal position. (See specimen of mammalian spine in museum of College of Physicians and Surgeons, New York.)

What is the reason that, out of a hundred pale, flabby, undertrained, and overstrained children who assume faulty attitudes, and

some of whom have flat-feet or crural asymmetry, only a few develop scoliosis ?

In estimating the effects of treatment it is necessary to know that many cases of lateral curvature are self-limited or, at least, do not progress very far even without treatment. I am constantly discovering mild or moderate forms of scoliosis in adults, in the course of examinations for other troubles, and some of whom have never suspected the existence of the spinal affection. On the other hand, it is even more important to know that very many cases do grow worse unless carefully managed, and some have a strong tendency to go on to extreme deformity, even under persistent treatment.

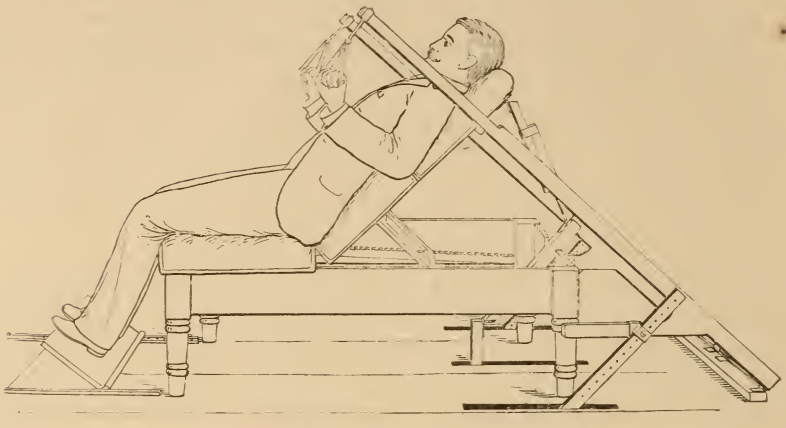
When beginning cases are brought for an opinion, certain data, such as the height, chest-expansion, and Roth's horizontal dorsal contour, should be noted, and they should be examined once in a few months to see if the deformity increases. In the meantime, explicit directions are given for the regulation of the mental, physical, and social life. It seems clear that regular habits, moderate exercise, stated complete rests in the daytime, and an open-air life, with the avoidance of physical, mental, and emotional forcing and strain, are a vast help to these patients, and I believe that the methodical employment of these rational means does arrest the progress of the curvature in many cases.

I have observed several instances of city school-children with moderate osseous curves, but who had never worn braces, who improved notably during a three-months' sojourn in the country, with a natural, open-air life. On the other hand, I have seen severe curvatures developed in sturdy children brought up in the country under apparently just as favorable conditions. Attention to these points, however, is always imperative, and often sufficient in the earlier and milder cases.

The backache and spinal tenderness, so sedulously sought by the inexpert, are not properly symptoms of lateral curvature. They may be symptoms of a system below par or of nervous or spinal weakness, and are often accompanied by headaches and other local and general symptoms. A few of these patients have lateral curvature in addition, and a moderate proportion of scoliotics have headache and backache as an expression of their general condition of health. The rib-pains, and other pains of some of the extreme cases,

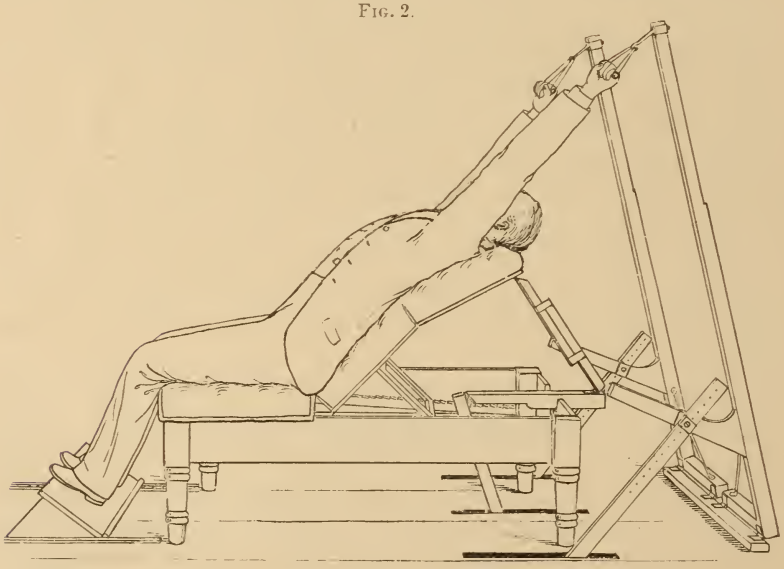
belong to a different category. These cases of backache, usually anæmic and with impaired digestion, nutrition and elimination, and

Fig. 1.



a faulty nervous and blood distribution, are much benefited by systematic attention to mode of life, general and special exercise, rest,

Fig. 2.



diet, bathing, and mental and moral hygiene, and if they, at the same time, happen to be suffering from scoliosis, these indications

are all the more clear and urgent. While lateral curvature is not caused by general lack of vigor, it is much more apt to develop in such constitutions, when the other necessary factors are present; when it is developed it acts as a constant drag and strain upon the economy through imperfect equilibrium, overworked muscles, and crowded viscera, according to the grade of the affection. By careful attention to the measures mentioned, for which it is necessary to give specific directions and to secure the coöperation of the patient and her family, and the use of special exercises, we are nearly always able to improve the general health and vigor of our patients, give tone to the muscles, relieve backache when present, increase endurance, and often improve the attitude and carriage of the body.

As chest power and capacity are threatened or already encroached upon, we give special attention to respiratory exercises, by which means we also favor oxygenation of the blood and improvement of nutrition and circulation, but are careful to avoid overtaxing a system in many instances already delicate and tired. To fulfil these indications we have found nothing so useful as certain specific exercises, mainly passive, adapted by Dr. C. Fayette Taylor from the system of Ling. The apparatus called the "respirator" (Figs. 1 and 2), elsewhere described,[1] actuated by steam-power and giving sixteen deep respiratory movements a minute, is prescribed for nearly all our scoliotic cases requiring special treatment.

By means of another power-apparatus we give alternate right and left lateral flexion, forty-six times a minute, of the trunk through the loins, the patient lying on the back. This increases lumbar flexibility, strengthens the muscles about the waist, and acts on the abdominal viscera.

Another useful exercise is taken while the patient lies on a couch made of two halves hinged in the middle, and so contrived that the body may be flexed and extended at the waist against a balancing weight, the upper or lower half being fixed at choice (Fig. 3).[2] This and the preceding are excellent exercises for improving abdom-

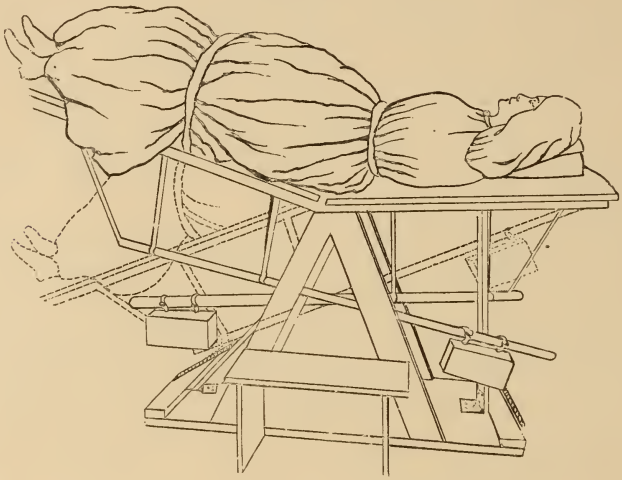
[1] "The Therapeutic Value of Systematic Passive Respiratory Movements." Medical Record, May 4, 1889.

[2] From "Spinal Irritation," by Dr. C. Fayette Taylor, p. 23. W. Wood, 1870.

inal circulation and increasing peristalsis, and the latter strengthens the back and abdominal muscles.

To attack the deformity directly we use lateral suspension from the hands, in an apparatus consisting of a vertical adjustable upright, hinged near the middle and carrying a reversible pad for pressure

Fig. 3.



upon the convexity of the main curve, and a hand-piece for grasping. When the upper part of the apparatus is drawn over to the side the patient is lifted from the floor, and the weight of the body forces the pad against the projecting ribs in the direction of the longest diagonal of the chest at the same time the concave or contracted side of the chest is expanded by the wider excursion of the corresponding arm (Fig. 4).[1]

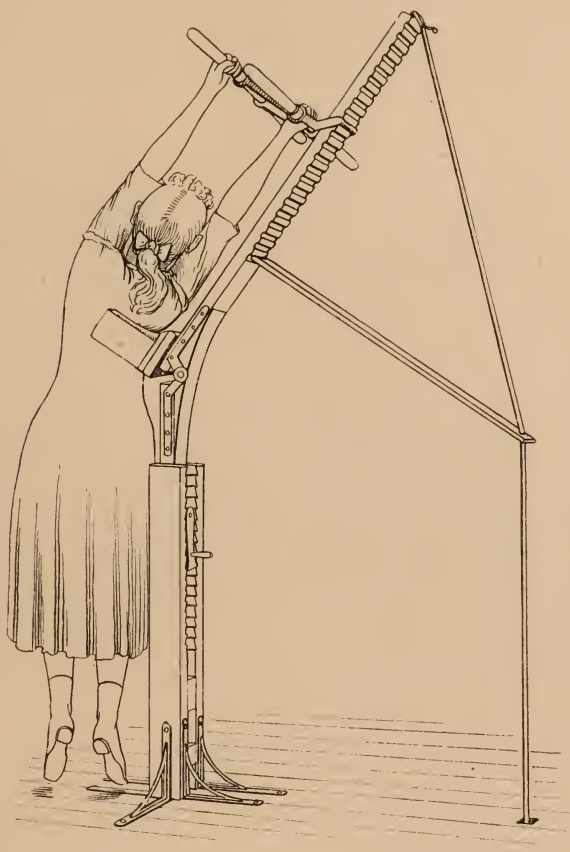
In addition to these movements, I have lately given to some of my patients certain active free exercises similar to those recommended by Roth.

We shall be in a better position to judge of the value of prescribed exercise in the treatment of scoliosis, when we have more exact information in relation to the special physiology of muscular

[1] Described and figured on page 98 in "Theory and Practice of the Movement Cure," by C. Fayette Taylor, 1860.

movements, and particularly of associated and coördinated movements. We know well that the contraction of any given muscle or group involves the contraction of many other muscles, in fact determines a change greater or less, in nearly every muscle and tissue of

Fig. 4.



the body, but we need to know how simple and combined movements affect carriage attitude and the normal and abnormal positions of the spinal column, and how these effects can be varied to produce specific results.

Whatever factors may be present in addition, we certainly have to do with a problem in balancing. The spinal column sustains the weight of the trunk, but the muscles balance the column. The varying tonicity of the trunk muscles, responsive to changes in position and strain, keep the unstable column delicately poised, but slight causes may disturb this harmonious action, especially in the period of muscular instability and spinal flexibility common in adolescence (and more marked in girls than in boys), and throw continued strain on feeble parts; further progressive changes will take place in the lines of least resistance.

It should be remembered that the centre of gravity of the human body lies in the upper lumbar region, in most cases to the right of the median plane,[1] which might help to explain the greater frequency of primary lumbar curves and the preponderance of the left lumbar and right dorsal position, since in balancing the body there would be a tendency to bring the upper lumbar vertebræ to the left of the median plane, in order to place the centre of gravity over the middle of the base-line.

The observation has been made[2] that scoliosis is rarely seen among people who have been trained from childhood to carry loads on the head, like the peasants of some parts of Europe and of some of the West India Islands. I have been struck with the firm, erect carriage of fencers. Both fencing and the carrying of loads on the head, are in part exercises in the fine and diffused muscular adjustments of balancing, and contain hints for the training of these cases.

Is it not possible that scoliosis, preëminently, so far as we are informed, an affection of civilized countries and cultivated classes so called, is fundamentally but one expression of the faulty, one-sided training of certain areas with corresponding starvation and atrophy of others that these conditions impose upon muscles and mind?

As to mechanical support to the spine, in addition to the measures already spoken of, my position is that it is of substantial benefit when properly managed in selected cases, and my aim is never to employ it whenever the patient can do as well without. This is a

[1] *Vide* a paper by Dr. John Struthers, Edinburgh Medical Journal, June, 1863, p. 1086.

[2] By Dr. C. Fayette Taylor.

matter for observation and judgment, but in practice only a certain proportion of the severer cases are so treated. The aim of mechanical support should be not only to correct or hold the spinal deformity, but also to relieve cramped, stretched, and atrophied parts of undue strain by the restoration, so far as may be, of a more normal dynamical equilibrium.

For this purpose we use a light steel apparatus, acting on the principle of lateral leverage, and worn only during the daytime, while the weight of the body is acting upon the spine.

Fig. 5.

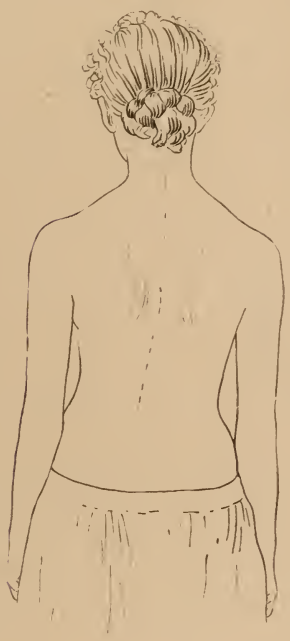
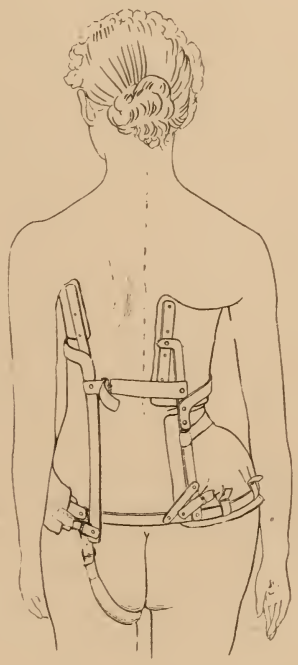


Fig. 6.

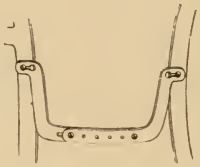


The details vary in each case according to the indications, but a general idea of a common form employed and its action may be gathered from the cuts (Figs. 5 and 6), which were taken, with slight modifications, from photographs of the same patient, and within a few minutes.

A light steel band, closed at one side by a strap and buckle, passes around the hips at the line of the trochanter; to this an H-

shaped braced steel upright, which carries a broad band of leather on its upper end for pressure against the projecting ribs of the convexity, is fixed at right angles, and the whole is held in position by a flexible hip-piece fitted over the ilium of the side of the prominent curve, and buckled to the hip-band. This hip-piece serves as a fulcrum when leverage is applied by the perineal strap, which unites the two ends of the hip-band, passes under the leg on the side opposite the main curve, and is regulated at the buckle behind. The counter-pressure on the side of the trunk opposite the main curve, higher or lower as is mechanically more advantageous in the particular case in hand, is given by a similar firm leather band supported on the upper ends of a separate steel H-piece, which is completed below by a strap over the hip. The two H-shaped side pieces are fastened together in front by an adjustable, bowed steel U-piece, with a keyhole at each end which slips over a screwhead about halfway up the front bars of the H-piece (Fig. 7), behind by a strap

Fig. 7.



and buckle, by which the pressure of the apparatus is adjusted. By working from fixed points on the pelvis (hip-piece and perineal strap), the swaying to one side of the trunk *en masse*, which is often one of the main difficulties, is directly opposed (*v.* Figs. 5 and 6). This apparatus requires the nicest judgment in design and the greatest care in its adaptation, and must be modified from time to time to meet special requirements, as the case progresses. It is only a tool, like a violin, which is capable of being manipulated to produce definite results by one who is skilled in its use. Here as everywhere in orthopedy it is a question of method not means, principles not rules, and men not machines.

I have but briefly mentioned some of the methods we have found useful, fully realizing that there is much more to learn than we now know in regard to this difficult and important subject; but in spite of

our defective knowledge on many points, we expect good results in the milder and earlier cases, and gratifying amelioration in all but the worst of the more advanced cases, provided we can secure hearty and full coöperation.

DISCUSSION.

Dr. George W. Ryan, of Cincinnati.—I do not know that I can say anything especially about the treatment. The ground has been covered so thoroughly by the papers that have been presented, that I feel like asking the gentlemen whether they can show any results of the various methods that have been used in these particular divisions, in the resistant and non-resistant cases, as Dr. Bradford terms them. The question of results would determine more than anything in the minds of members as to the value of the treatment.

One of the papers begins with a statement as to what the cause of lateral curvature is, and the divisions that have been made, probably clinical ones, are simply those of degree. In the first place, there are certain stages in lateral curvature, just as there are in other diseases and distortions, and it strikes me it might be difficult at times to draw the line and make up our mind in which division we should place any particular case. There is adolescence, the beginning of it—the second stage of it, as it might be called.

I am not given very much to the use of apparatus in the treatment of lateral curvature. I have not used anything outside of the plaster jacket for the past three years. I have used that in a considerable number of cases, such as have been described, with good results. In the case of a girl of fourteen, the best thing to do is to put the patient in plaster when suspended, and have the jacket so arranged that it may be taken off every night for certain muscular exercises, such as are recommended by Mr. Roth. I also recommend, in the case of girls who live out of the city, that they buy a suspension apparatus, and under the directions of the family suspend themselves every morning, so that the jacket shall fit them throughout the day. I have a great deal of confidence in the exercise-treatment in the case of children, and in all cases where the curvature is a recent one. The confidence I have in it has been justified in this way: they do

not get worse, or very little worse. That has been my experience in the treatment of lateral curvature. I have seen a few cases in which I was positive a change had taken place for the better in the curve. I am entirely satisfied of that fact, after years of treatment. By means of exercise these cases certainly do not grow any worse, and sometimes I congratulate myself, and the patient likewise. I have not used a steel apparatus in connection with it for many years. It is difficult for the friends of the patient to realize that it requires a great deal of attention, and a certain number of visits to the office that they cannot see the necessity for. If they could realize the necessity of exercise, with a watchful mother, in the majority of cases the treatment can be successfully carried out.

Dr. Ap Morgan Vance, of Louisville.—I used to be an enthusiastic brace-maker years ago, and used braces in the treatment of lateral curvature. I have not for the past ten years applied any form of brace to a case of lateral curvature, having become convinced in my mind that no good could be brought about by them in the permanent correction of the deformity. I cannot believe that any form of apparatus that is applied from the pelvis to the armpits can in any way exert any correcting force upon the rotated vertebræ. I can understand how a certain amount of chest-bulging, how a certain amount of compensatory curve could be temporarily removed or would disappear under this force, but I cannot see how, from a mechanical standpoint, we can unrotate or turn back vertebræ into their natural position by any force applied to the lateral walls of the chest. The only way of applying force, to my mind, which would tend to untwist or turn back these rotated vertebræ, would be by continual suspension by the head. I can understand if the apparatus is made so that the pelvis can be used as a base and the head as a point of attaching force, it can be straightened out to a certain degree. How any of the jackets or any of the spinal braces can exert any force on the rotated vertebræ I am not able to see.

I have been in the habit during the last ten years of establishing a certain course of gymnastics, and have experienced a great deal of difficulty, because patients live at a great distance, so I had to do the best I could. I depend on self-suspension by the head, reclining during the day and night in a position that will over-correct the

curve, and at the same time requesting the discontinuance of any occupation that would depress the general health; treat them by tonics and massage, instructing them to exercise freely and to do horseback-riding, and particularly thoracic gymnastics—that is, systematic or voluntary inhalations, so as to enable them to develop the lungs properly and improve their carriage. I believe this is an important factor in the treatment. I believe we should do everything possible to improve the patient's resistance to any influence that produces depression of the general condition. I believe rotary lateral curvature to be incurable, and I think that finally every one of these cases goes to the hands of a cosmetic dressmaker. I have never seen one that did not. The mechanical treatment of lateral curvature of the spine ought to be obsolete.

Dr. Benjamin Lee, of Philadelphia.—I have nothing to add to the very careful analysis made by Dr. Bradford of the different stages of lateral curvature. He has certainly taken up the subject in a very scientific spirit. I would differ with him, however, as regards the treatment of the early stage. There are undoubtedly cases where the physician feels confident that a system of exercises carefully carried out will be quite sufficient, without anything else, to effect a cure. There are other cases, and especially those in which he can detect a slight rotation in the lumbar region, in which exercise alone will not be sufficient. I would agree with Dr. Judson in considering it important to apply such support as will induce a temporary lordosis in all of these early cases where we can detect the slightest rotation. My theory has not been the same, however, as his. I have applied it because I believe the disease or the distortion usually begins in the lumbar region, and that we must attack it first. I usually apply a light spring, made either of brass or steel. I rather prefer brass. This spring is made broad at one point, tapering toward either end. The point at which the spring is broadest will give the point of greatest pressure. That point of pressure depends upon the curvature which you notice when the child bends considerably forward. If you notice, on placing a child in that position, a lumbar curve laterally, you want to make your pressure at the point of greatest curvature. I believe that by early applying this light spring, I succeed in many cases in checking the

distortion in its incipiency, and often in complete restoration of the form.

Years ago I used a very powerful appliance, that of Heather Bigg, working from two centres by means of ratchets. I used it with considerable benefit. But it was very heavy and often painful, and I concluded I could obtain as good results by a lighter form of apparatus, and one more simple in construction. So far as lateral action is concerned, I depend upon spring power. I adjust to my pelvic belt a lateral spring, which is shaped tolerably closely to the natural curves of the patient, and, attached to that, a band passing around the opposite side. In some cases I use simply one spring; in other cases a spring on either side. Of course, I have used jackets, but never could bring myself to keep the patient very long in plaster. I, consequently, adopted a porous felt jacket as a substitute, but I was unable to convince myself that my patients made any better progress with the jacket than they did with the lateral spring apparatus of which I have spoken. The exercises which I make use of, I shall be happy to show the members at my office to-morrow.

Dr. Reginald H. Sayre, of New York.—I do not agree with Dr. Vance in his idea that the patient will, although the thorax is capable of being made symmetrical, after the removal of pressure, return to the same condition as before. Dr. Bradford has expressed my ideas almost exactly in regard to the treatment of lateral curvature. In these cases of adolescence, after they arrive at puberty, when the bones are not so flexible, if Dr. Vance by his apparatus can keep the thorax approximately symmetrical until the bones have lost their elasticity, I cannot see why they should spring back to the distorted position from which he originally twisted them. I do not see why they should not stay symmetrical. If he has kept up that for a number of years in the correct position, I know of no reason why they should not remain symmetrical when he relieves the pressure. With the hands, I know, you can certainly restore in these young cases a great deal of the symmetry of form, and I wish we had some mechanical means as intelligent as the human hand. I feel convinced if we could keep up manual pressure on these

cases in the incipient stage, I mean for a certain length of time, we would get them well with very little distortion.

I have used the prone position instead of the supine in a great many of these cases. I have been in the habit of putting a large sandbag on the convexity, keeping it in the position I want it to retain. Dr. Vance does not see, nor does Dr. Judson, how it can exercise any unrotating power upon the curved spine. Here (illustrating) we have our rotated processes; we have our bodies articulating here with the ribs, and if we apply pressure, it seems to me, from a mechanical point of view, that pressure is certainly transmitted to the side of the vertebræ to rotate the vertebræ to a direct position. If you come on the other side, as Dr. Judson assumed in his argument, and make lateral pressure, you are going to force the spine further round to the bad; but if the pressure comes from the spine outward and forward it is in the direction to correct the rotation and untwist it; and I have had better results in doing that by means of the prone position and the sandbag than by means of pillows, Beely's leap-frog position, etc. I think this is an admirable means.

Up to the present time I have not found anything which answered my purpose so well as a plaster-of-Paris corset when a support is required, and I disagree with Dr. Vance in thinking it is never required —because there are some of these cases, old advanced cases, that have gotten into such a condition that they must have mechanical support, as there is pressure of the ribs against each other and pressure against the pelvis. In these cases, as well as in the more incipient ones, I have found nothing so valuable as jackets. I have tried many things. I can conceive of something better than a jacket, but so far I have not met anything which answered my purpose as well as a plaster corset. Of course, it does not answer the purpose as well as my hands. I have not devised any mechanical appliance to take the place of the hands, and thus vary the pressure as the patient is walking around.

Dr. A. B. Judson, of New York.—When considering the treatment of lateral curvature, as on many other occasions in practice, we cannot help wishing that it were possible to do by the use of an apparatus what we can do manually. Pressure made by an apparatus has the disadvantage that it must be applied to the ribs and directed

toward the centre of the trunk, with counter-pressure from the opposite side also directed toward the centre. Force thus applied is useless as opposed to the rotation of the column. But with the hands applied to the ribs the body may be rolled between the two palms, and the pressure thus applied is not directed toward the centre and it may be supposed to act against the rotation. This can hardly be done with an apparatus. And even if the apparatus is designed to make pressure not directed toward the centre, with a fixed point at the pelvis, with the purpose of untwisting the rotation, it is to be feared that the force applied to reduce the rotation of one of the curves would do harm by promoting the rotation of the other curve, which is in the opposite direction, or in the same direction in which the force is applied.

Dr. Sayre.—Suppose, for instance, we put on two rotating twists —one a twist to the right and the other to the left—to twist both curves, to control the position which they have. That is the idea.

Dr. Judson.—An apparatus designed to act thus in opposite directions might prove too complicated to be useful in practice. In regard to suspension, of which Dr. Ryan spoke, I think it is desirable for patients to have a suspension-apparatus at home, and I would recommend that they have it in their bedroom, in a doorway, so that in the morning and evening they can use it and take a rest after each suspension. In this way the child, while dressing in the morning, will suspend itself six or eight times, with a suitable rest after each effort, and at night more exercise may be taken, because it is followed by a long period of repose at night.

Dr. L. A. Weigel, of Rochester, N. Y.—I believe, with Dr. Bradford, that the various stages of lateral curvature differ simply in degree. When a case of incipient lateral curvature presents itself it is a difficult matter to decide whether it will be progressive in character, and go from bad to worse if left untreated. We do know, however, that many cases that have reached the stage of moderate resistance remain at that point for a long time, and, perhaps, permanently, without any treatment whatever; while in others the deformity increases in spite of the most careful, systematic, and persistent treatment.

The question of treatment seems to be about uniform, so far as those are concerned who adopt any treatment at all with the hope of improving the general health of the patient, etc., that is, proper exercises in the early stages, with the addition of mechanical support in the later stages. This has been my practice for some time. I invariably give patients a self-suspension apparatus to use at home, directing them to use it twice a day—morning and evening—together with floor-exercise and such other gymnastics as may be necessary in each particular case.

The question of respiratory exercise is an important one. It is also important to see that the respiratory organs are in a proper condition to exercise their function. I was forcibly impressed with this fact in a case now under treatment. When the patient first presented herself for examination she was suffering greatly from nasal obstruction, which probably accounted, in part at least, for her extremely anæmic condition. After the removal of a large mass of hypertrophied tissue and the reëstablishment of normal respiration, her general condition began to improve at once. Respiratory exercises in cases of such marked nasal obstruction would be of little avail. Dr. Vance spoke of mechanical support as an element in the production of muscular atrophy and general debility of the patient, by interfering with the proper exercise of the thoracic muscles. This objection to mechanical support would, no doubt, be valid if the thorax were rigidly encased and respiration markedly interfered with. Mechanical treatment of this character is undoubtedly wrong in principle. I use jackets for mechanical support, which, however, I invariably lace with an elastic instead of a rigid lacer. By this means normal respiration is but slightly interfered with; moreover, the support is more constant, for the reason that the thoracic walls remain in contact with the jacket at all times, which would not be the case if a rigid lacer were used, because of the ever-changing intrathoracic pressure. The support would be an intermittent one.

Dr. Milliken.—Dr. Sayre spoke of using pressure in this direction (illustrating). Dr. Judson said that we could not get a basis of support. Now, it occurs to me that the pelvis itself would answer the purpose. If we had a broad, stout band encircling the pelvis, and from the back of that band we had the old-fashioned bar spring that

was formerly used to close a door run up alongside the spine, would not a constant force be exerted on the twisted spinal column by attaching a broad piece of adhesive plaster to the projecting chest-wall, running the strip around in front of the chest and attaching it to the spring here (illustrating)? A similar spring, acting in the opposite direction, could be used to exert its force on the compensatory curve.

Dr. A. J. Steele, of St. Louis.—I depend for correction of the deformity mostly on exercises of various kinds, gymnastics, recumbency, the supine position, etc. I employ two exercises which, I think, are original with me, one of which I suggested at our last meeting. It consists of a trapeze bar, the side corresponding to the low shoulder being the highest. The hands grasp this bar above, and the feet below are fixed to the floor. Ordinary roller skates are convenient means at hand for this purpose, fastened directly to the floor or to a board, which, by means of a screw or bolt, is fixed to the floor. The feet thus fastened below and hands above, the body is made to gyrate around and around. I endeavor to obtain free movements between the bodies of the vertebræ, in order to render the spine flexible; then there is a chance for correct repositioning. Much can be done by this exercise.

Some years ago I saw in Dr. Judson's office a machine for gymnastic exercises, consisting of a large roller over which the spine is bent backward, producing great lordosis. I use this apparatus constantly. The more erect we make patients carry themselves, the less marked is the deformity. If you wish to diagnose a case you have the patient lean forward, because it increases the deformity, the rotation. So, on the other hand, if she stands very erect, it seems to diminish it. Thus I aim at erectness, even lordosis. By these two exercises—the roller on the one hand, and the gyrating movement on the other—patients learn to stand very erect.

As regards the use of portable appliances or apparatus, I do not use steel plates, bars, straps, etc. At the Royal Orthopedic Hospital, one afternoon, I saw two dozen cases of lateral curvature in young women. The treatment consisted of portable steel braces, with pads and straps. The doctor, with a key, would screw them up little by little, until they seemed to me to be instruments of tor-

ture. Dependence was placed upon these supports to cure the patients. I innocently asked the doctor if he got cures by this method. He thought he obtained as good results as other surgeons. I have never but once used anything of that sort, and I think I never shall again.

I have been doing a great deal of work recently in leather. This (illustrating) is a leather jacket made from a single piece, and passing up over the shoulders. It was made for a little girl with torticollis. To this I shall attach my head-support for correction of the wryneck. The child had also a lateral curvature, but it was not made to correct the deformity of the spine, because that will pass away with the torticollis. I merely show it as an illustration of what admirable splints can be made with leather. I use russet skirting, as it has no oil in it; it can be softened in water, and hardens after being wound upon a cast of the body. I use a foot lever to increase the tension of the cord so that it is thoroughly adapted to the cast. The leather can be made as hard as you desire by baking, but the heat should not be carried too far. By means of heat we produce a change which hardens the leather. I obtain good support in cases of lateral curvature with these leather braces, and they give great comfort. It is not worn permanently; it can be removed at any time when the patient takes exercise, and at night. I have treated many cases without using any jacket whatever. I do not know whether this idea of carrying the jacket above the shoulders is original with me or not.

We get good results in the treatment of lateral curvature. I have cases in the third degree where, after two or three years of proper treatment, the curvature was hardly perceptible. It requires patience, perseverance, and persistence on the part of the mother, as well as pluck in the patient herself, to accomplish this.

Dr. Ryan.—I would like to ask Dr. Steele whether the cases (in which he has had good results) are common?

Dr. Steele.—I get fair results in the majority of cases. If they are far advanced, the bones are already deformed, and we do not expect straightening. But in the first and second degrees we get cures, and in the third much improvement.

Dr. Arthur J. Gillette, of St. Paul, Minn.—We all agree that exercise is of great benefit in cases of lateral curvature. Dr. Vance, I think, referred to horseback-riding as a form of exercise. It occurs to me, Mr. President, that that is one of the worst things a young lady can undertake.

I would ask Dr. Ryan what form of suspension apparatus he advises his patients to get?

Dr. Ryan.—The ordinary suspension apparatus I have in my office.

Dr. Gillette.—It does not seem to me advisable to put such an apparatus in the hands of a patient. I have had two cases which frightened me not a little, in which the suspension apparatus was used by the patients themselves. They were not cases of lateral curvature, but of tabes.

Dr. Sayre.—In regard to what Dr. Gillette has said about the danger of suspension in lateral curvature by the patients themselves, I think, possibly, it may be well to raise a note of warning. I reported such a case some three years ago at the New York Academy of Medicine. The patient was from an epileptic family. She had a fainting-fit the day before, and she had been instructed, as all my patients are, to have some one with her while she suspended herself. The girl who gave her exercise had gone out on this Sunday evening, so the patient went to her room and suspended herself alone. The family, on going to bed, saw a light burning in her room, and found her hanging in the swing. She was hanging with her head in the chin-piece and her arms by the side. Whether she had a fainting-fit or how it occurred nobody knows. I always tell my patients that they must have some one present while they suspend themselves.

A short time ago a somewhat similar accident happened to my instrument-maker in New York. He was devising a little scheme by which you could climb up a rope, it being about the time of the rage for the suspension-treatment for tabes. He devised a little ingenious instrument to this effect, that when you grasped the handle it caught the rope, but, by pushing up, you could slide it up the rope, and by grasping it again you could hold the rope firmly. He

put his head in the sling; pushing his hands up, he climbed up nicely, but could not let go as long as he held on to the handles, and he was suspended. He called for assistance, and was taken down. I can imagine a patient getting in a somewhat similar predicament without assistance and meeting with a fatal accident.

I think it is well for these patients always to have some one present when they suspend themselves. Of course, they are not expected to faint in the apparatus, but people faint at very unfortunate times.

Dr. Samuel Ketch, of New York.—It is an unfortunate fact in connection with cases of rotary lateral curvature that, as a rule, they go to a surgeon at such a time when treatment is of the least avail. Coming as they do to us at this time, it certainly seems as though it is our duty to do something for them, and the question of exercises and apparatus has already been thoroughly gone over. It seems, however, that there is quite as wide divergence of views on the question of treatment as there was in regard to the etiology of the affection. Out of it all it would seem that we do have a measure of success in the treatment of lateral curvature.

There is one point that I desire to call the attention of the members to, and that is this: we are all too apt to look upon an apparatus, a brace, as an active factor in the treatment of the deformity. It would seem to me that, beginning our treatment with exercise,—and it seems the rational thing to do,—the best we can expect of any apparatus (and that apparatus is the best with which the surgeon is the most familiar) is to follow up the amount of gain we get with exercise by the apparatus; in other words, if we get our patient into a certain position, if we can gain a little on the curve, all we expect from any apparatus is to hold the patient in that position. The question of leather, plaster, or steel is a secondary one. I have heard the same story about the torture connected with steel apparatus that Dr. Steele has given us to-day. I think that is not the fault of the apparatus; I think it is the fault of the man who uses it. There is no reason why steel, or any malleable material, cannot be used without any more injury to the patient than with leather, plaster, or felt.

I have waited rather anxiously to hear another side of this question discussed—one I proposed at the meeting of this Association at Washington, some years ago, viz., the prevention of lateral curvature

—the prophylaxis, so to speak. It seems to me that if patients, or the public, rather, were as well informed concerning the deformity as they are, for instance, at present regarding joint diseases, many of the distressing deformities which we see might have been prevented. I made a plea at that time for the careful inspection of young children's backs. The attention of parents should be directed to the condition of their children as early as possible, and the cases should not be allowed to go on until such a time when, as a rule, the best we can hope to do is to prevent a further increase of the deformity. If, however, the cases are seen early enough, when the children are young and the tissues soft, I am sure the proportion of deformities we see at or about the age of puberty would not be great at all, or occur in such a very slight measure that they would be hardly noticeable.

Dr. Weigel spoke about the treatment of incipient cases, and stated that he had no doubt if many of the cases were allowed to go on they would not increase. I have been waiting for many years in all sorts of deformities for information or points which will tell us accurately which cases will get worse and which cases will not get worse without treatment, and up to the present time I have not been able to discover any accurate guides for such prognosis. It seems to me that if ever there was a time to do anything for lateral curvature, it is in the incipient cases. I mean those cases with the smallest amount of rotation, or practically none, and which are usually simple cases of lateral curvature, or deviation of the spine without rotation from weakened muscular force, especially in the long intrinsic muscles.

In regard to exercise: it would seem to me that form of exercise which is directed toward the intrinsic muscles, of which I spoke this morning, would be of the greatest benefit. If we get a set of exercises that would act accurately on these muscles, we will be able to do more toward undoing the rotation than by any other means. If you look into the exercises as employed, most of them are directed against the long muscles of the spine. With the views expressed regarding the muscular causation of disease, it is not our object in lateral curvature to increase the action of any muscle. We are trying to undo the action of the muscle, and these muscles, to my mind, are the intrinsic muscles that go from vertebra to vertebra.

Regarding any support, I should consider that inefficient unless it came from the pelvis. If we wish to employ a support—a support which will keep up what we can gain by exercise—it seems to me the force must be directed from the pelvis; in other words, if we can make a fixed point opposite to the curve, and then, with the pelvis as our base, have a centre of motion, we will get a force there having the lever principle, its direction being against the greatest convexity of the curvature. Such an apparatus has been in use for a number of years, as devised by Dr. Shaffer, and has been used in the New York Orthopedic Dispensary.

I had the honor of reading a paper before the Orthopedic Section of the New York Academy of Medicine on the "Status of the Treatment of Lateral Curvature," in which I supported most of the views that have been held by the gentlemen present.

I quite agree with Dr. Vance when he says that in those cases of extreme rotation we cannot undo the rotation; but I believe there comes a time when the disease is arrested—in other words, when the rotation stops, and if we desist from any form of treatment before that time, it seems to me that we would be running great risk—that we would be allowing our patient to go on with an indefinite end to his trouble.

In concluding these remarks, I would again enter a plea for the examination of the spines of infants; the direction of the attention of the parents to their children's backs, and if they see anything wrong they shall take them at once to a surgeon, as is now done in cases of joint-disease, for in the treatment of lateral curvature we can do a great deal if, as in joint-disease, we have an early opportunity of arresting the progress of the malady.

Dr. John Ridlon, of New York.—With reference to the remarks just made by Dr. Ketch: he has reported a large number of cases where the deformity unquestionably commenced at a very early age. Now, in these cases where the deformity was discovered when children were small, I would like to ask of him, and of the rest of the members: Have you seen any of the cases in these small children, under any form of treatment, get entirely well? Have you seen any of them that did not grow somewhat worse? My experience

with small children is, that it is impossible to keep them from getting worse. I do not recall a single case in a child under six years that has not grown worse.

By successful cases I mean necessarily those in which one gets a gain, and now and then even a cure. The successful cases in my hands are in young, tall, flexible girls, who at thirteen, fourteen, or fifteen years are as tall as they are ever going to be. These are favorable cases; whereas, in small children, no matter how slight the curve, how flexible the deformity, the cases are pretty sure to get worse under any form of treatment. The reason appears to be this: With a given circle, of which the curve is an arc, as the child grows the arc increases and the deformity becomes apparently worse, though the curve remain an arc of the same circle. So long as the child grows, then, the curve must either grow worse, or be arrested, or be improved by the surgeon. This brings up the question, How long must a case be treated? Some gentlemen have been treating cases a year or more, others three years. I believe every case must be treated at least as long as the patient continues to grow, whether it be one, fifteen, or twenty years.

As regards the apparatus, the principle of which is indicated on the blackboard by Dr. Keitch, and with which many of us are familiar, I used that apparatus for seven or eight years, and I have seen it used by many others. I think the principles of it are wrong. I have discarded it, for the reason that I have seen no patients where that apparatus was applied that have not grown progressively worse.

Dr. Weigel.—Dr. Ryan and some other gentlemen spoke about suspension and its dangers. I would like to ask Dr. Ryan whether he uses an ordinary suspension apparatus with compound pulley?

Dr. Ryan.—An ordinary compound-pulley apparatus.

Dr. Weigel (resuming).—I think that is one of the dangers of the apparatus. I use the compound-pulley apparatus in my office, but for use at home I give patients a single-pulley apparatus.

Dr. Lee.—I believe I was the first person to use self-suspension in the treatment of spinal affections, and especially of the affection which we have been considering to-day. I have, therefore, when two or three times I heard of accidents occurring in its use, felt that I had a sort of individual responsibility, and I was about to speak of this before. Dr. Weigel raised the point—in which I entirely concur—that while in the office it is safe to use a compound pulley, yet we should never give our patients a compound pulley to use at home. I have always given them the simple pulley. I have furnished patients spinal swings for use at home for the past twenty years. No patient of mine has ever met with an accident, or been in the least alarmed, while employing self-suspension.

With reference to the question of rotation and the impossibility of producing an effect on it by apparatus. While we cannot hope to accomplish much by pressure against the ribs, is it not possible, where we have a commencing lumbar curve, that if we make pressure against the transverse processes we may produce an effect upon the rotation? We know that in all of these cases of rotary lateral curvature, where we have any curve of the lumbar region, if the patient stoops that curve is increased laterally, and at the same time the rotation is increased. Now, when I put my light spring brace upon a patient in that condition, while she is erect, there is no decided action, but the moment that, in stooping, she begins to throw out this curve laterally and produces rotation, there is at once an elastic force exerted against the rotation and against the lateral curve at the same time. I believe we can accomplish something by acting against the transverse processes in the dorsal region, but we cannot hope to accomplish as much there as in the lumbar region.

Dr. Robert W. Lovett, of Boston.—It seems to me that in the discussion one of the most important classes of patients was lost sight of. I refer to dispensary patients, where it is difficult to control and direct gymnastic exercises, consequently the pure gymnastic treatment is not practicable, and it is a problem that we have to meet. Recently, in these cases, I have followed a plan which has certainly yielded better results than anything I have previously tried. In connection with having the patients carry out certain gymnastic exercises under the supervision of some one at the hos-

pital, I have found practicable the application of a removable support in the form of a plaster jacket made in a particular way. If the plaster jacket is advisable to use, this form is most satisfactory. It is a hint for which I am indebted to Dr. Bartow. The jacket is applied while the patient is suspended, or not, as seems advisable; the jacket is then cut off and a cast of the patient made from that; then with a knife the lateral deviations are corrected, not altogether making it straight, but improving the position, so that it comes approximately into a correct form—that is to say, it represents the condition of the patient if she were decidedly improved. Then, over that, instead of applying a leather jacket, as Dr. Bartow does, I apply an ordinary plaster jacket, which is cut off and provided with lacings, so that it can be applied to the patient easily. Where the gymnastic drill must be necessarily unsatisfactory and imperfect, the results of this form of treatment have been very much more gratifying and satisfactory than anything I have ever used.

Dr. De Forest Willard, of Philadelphia.—I am gratified with the papers that have been to-day presented, and with the discussion that has followed. We entertain very different views—and it was with that expectation that I selected this subject, as it is one capable of great diversity of opinion; yet we do agree upon certain main points. It is not to be expected that we should agree as to the etiology of lateral curvature, which, unfortunately for our rapid progress, cannot be studied in a short time. It is almost the work of a lifetime to get together a few facts, and we are apt to die before our patients do. We cannot watch a given case from its inception until it reaches the post-mortem table. We find so much difficulty in tracing the pathology and etiology that we must simply take the accumulated evidence on all sides. Let each one of us investigate and accumulate all the facts that he possibly can; and, finally, by combining our deductions, individually and as a whole, we shall be able to discover the true cause. It may be by some of us; it may be by our children. The time, however, will certainly come, and I trust that to-day's discussion will hasten it.

There seems to be great uniformity in regard to the value of muscular exercises. They are helpful means, and, in some cases, are curative. While some few absolutely throw aside all apparatus,

yet nearly all of us agree that, in bad cases, some form of apparatus is at least suggestive to the patient, just as are gymnastic exercises. While apparatus is an evil, it is sometimes a necessary evil.

In the case of careless young girls with lateral curvature, the prescribed forms of gymnastics assist, each morning, in reminding our patient that she is not a well individual, but that she must give attention to her walk, position, etc.; that she must care for herself during the day; and the more frequently we remind her of this fact the better will be her carriage and the better the result which we shall obtain. We do agree in that, at least. If we can keep this idea before her, we will do much good, no matter what our means may be. We can vary them according to the individual wants. We can exercise one muscle, or all the muscles. By these movements we also increase and improve the general tone of the system.

We are advancing. This discussion to-day has helped to clear the skies. It has made me feel hopeful. We can help and give comfort, even in the worst cases. I do not feel discouraged by the results we have so far attained, and in the future, by discovering the cause of lateral curvature, we shall be able to adopt a plan of treatment that will be curative.

I am also very glad indeed that this malady has been discussed from different standpoints. I feel that I have been amply justified in the selection of the subject, and I hope it will keep each one of us thinking during the year.

A REPORT OF SIXTY-TWO CASES OF HIP-DISEASE,

OBSERVED IN THE PRACTICE OF HUGH OWEN THOMAS, OF LIVERPOOL.

By JOHN RIDLON, M.D.,

With a desire to present for your consideration further facts regarding the use of the Thomas hip-splint, I spent twelve days during the month of June of this year in Liverpool and examined all the cases of hip-disease coming under the observation of Mr. Thomas during that time.

It had been my desire to make a report upon cured cases, but I found that no records of cases had been kept, and that even the names and addresses of patients were wanting. I therefore contented myself with taking all cases as they came, not with the idea of showing ultimate results, but rather the presenting of a picture of Mr. Thomas's daily work. New cases will be presented; cases where the treatment has just been commenced; cases that have been under treatment one and two years; cases that have been under treatment five and six years; cured cases; cases among the poor, and among the well-to-do; and cases that have done badly, and cases that have done well. I realize, as must every one else, that a much more brilliant showing would have been made had only cured cases been considered; but it is not to make a brilliant showing that I present this report—my only desire is to present to you the facts as I found them.

Every opportunity was given me by Mr. Thomas to question and examine the patients; and the facts which I shall present to you were obtained from the patients themselves, or their parents, and the measurements were all made by me.

Statements as to the degree of deformity present when treatment was commenced, and as to the length of time spent in bed, I found to be so uncertain that they have been omitted, and I have contented myself with recording only the time from the beginning of the limp, or pain, or both, to the commencement of treatment; the time which the long splint was worn; the time which the short splint was worn; the time since treatment was discontinued, in cured cases; the presence or absence of abscesses, and if present, when they appeared and how many, and the sinuses remaining; and the presence or absence of pain. The examination consisted of inspecting the patient as to his general condition; noting the presence of abscesses, sinuses, and cicatrices of sinuses; flexing the well leg on the chest while the affected leg was held in full extension; measuring the length of the legs, the degree of flexion, and of abduction or adduction; and testing the motion in those cases where the splint was for any cause removed.

The standard position taken for measuring flexion was that which is known as "Thomas's flexion-test position"—that is to say, the well leg is flexed on the chest to such a degree that the elbow can be hooked through the flexure of the knee, the anterior surface of the elbow being in contact with the popliteal space, and the forearm at right angles across the body. This position effectually overcomes all lordosis, and in some cases gives a lumbar kyphosis, so that if the affected leg can be carried down to the table—the patient, of course, being supine—it shows that the joint is free from all flexion, and that extension to a certain degree is possible. With the patient, then, in the flexion-test position, the angle of flexion was measured after the plan of Dr. Kingsley, of Boston.[1] In those cases where motion was not tested, because the patient was not removed from the splint, if the well leg could be flexed on the chest to the flexion-test position while the affected leg was confined in the splint, the popliteal space resting on the table, it was considered as being free from flexion, and so noted. It will be found that in all cases where flexion is present, or where any special joint-tenderness remains, that it will either be impossible to flex the well leg to the flexion-test position, or very painful, and that involuntary muscular spasm

[1] G. L. Kingsley: Boston Med. and Surg. Journ., July 5, 1888.

can be as readily detected as on manipulating the affected leg. I have, on that account, noted whether there was present or absent tenderness on flexing the well leg into the flexion-test position. The terms "real" and "apparent" shortening, or lengthening, are used in the same sense as suggested by Dr. Lovett,[1] of Boston, and the abduction or adduction is calculated by Dr. Lovett's table.

Sixty-two cases of unilateral hip-disease were seen and examined. Four of them (I., II., III., IV.) were new cases, and are recorded simply to show the condition of cases when they present for treatment. They are omitted from all the calculations, excepting that of the average duration of the limp before commencement of treatment.

The three cases—to wit, XXXIII., LX., LXI.—were children in well-to-do families, and had received the care that we are accustomed to expect in private cases. It is not surprising, then, to find that in these cases the results are better than the average in the other cases. All the remaining cases were from among the poorer classes, who, from ignorance and poverty, had received no better care than the dispensary class receive with us. Indeed, many of them were charity cases, and the sum total which these patients pay to Mr. Thomas for splint and treatment is, I have no doubt, no greater than dispensary patients with us are accustomed to pay for the traction hip-splint, and in many cases not as much. It should, therefore, be evident than any assumption that Mr. Thomas ought to get better results than have elsewhere been reported, because his patients are private patients, is unfair.

The average duration of limp before treatment was commenced, in these sixty-two cases, was a little over ten months.

The average duration of treatment was not computed, as only a few were cured cases, and as many had been under treatment but a short time.

The "long splint" referred to, is that which is ordinarily known as the Thomas splint, and extends from the lower angle of the scapula to the lower third of the leg. The "short splint" is the long splint cut off, and not extending below the knee. Contrary to what we have been taught, it was found that the long splint had not

[1] R. W. Lovett: Boston Med. and Surg. Journ., March 8, 1888.

always been put on at the beginning of treatment, but that the short splint, which "does not lock the knee," had been put on instead. In some cases the short splint had been replaced later by the long splint, but in other cases it had been continued throughout the entire course of treatment. Contrary, also, to what we have been taught, nearly all of these children were found walking around without high patten and crutches. In the same way cases were allowed to walk before the deformity had been overcome, and while muscular spasm and deformity, and sometimes pain, still persisted.

Of the 58 cases that had been under treatment for a longer or shorter time, 24 had shortening; 24 had adduction; 5 had abduction; 3 had inward rotation, and 2 had outward rotation. In the cases where abduction coexisted with shortening, the abduction was an advantage, as it compensated in a measure for the shortening.

Of the 24 cases where there was real shortening, 2 had one-fourth inch; 9 had one-half inch; 4 had three-fourths inch; 3 had one inch; 4 had one and a half inches; 1 had two inches, and 1 had two and a half inches. In 2 cases the affected leg was actually longer than the other leg.

One case had in-knee, apparently resulting from the action of the adductor muscles of the thigh while the ankle was held by the splint and the knee was not. It should be noted that this patient was walking around without patten and crutches, while there still remained a very tense involuntary spasm of the adductor muscles.

Of the 58 cases, 23 had, at some time during their course—some before, but many after treatment had been commenced—presented one or more abscesses. Of these, one had disappeared without opening, and another was fast disappearing.

In 31 cases the motion was not tested, for the reasons above stated. In 27 it was tested: 12 had no motion; 10 had some motion; 2 had motion to 90 degrees, and 3 had normal motion. It should be borne in mind that these 27 cases in which motion was tested were either cured cases, or so well advanced in convalescence that it was not thought in any way a risk to test the motion very thoroughly; while of those not tested, it would seem probable that very many would have shown considerable motion, inasmuch as they showed free flexion of the well leg to the flexion-test position; or, in other words, they showed normal extension of the affected limb.

All these cases, unless otherwise so stated, were in good general health.

The record of the cases is as follows:

Case I.—Female, aged fifteen years. Has limped at times, and complained of some pain for three years. There is involuntary muscular spasm and flinching on manipulating the leg; but there is no deformity, and the patient can be put in the "Thomas flexion-test position" without pain or any special effort. Mr. Thomas refused to commence treatment without further observing the case.

Case II.—Female, aged twelve years; limp for six months; no complaint of pain; no night-cries; no abscess; general condition fairly good; one inch real, but only one-quarter inch apparent, shortening; abduction, six degrees; flexion, twenty degrees; some motion in flexion; well-marked involuntary muscular spasm. Hip-splint now applied.

Case III.—Female, aged eight years; limp for three months before treatment was commenced; long splint applied at the Liverpool Infirmary two months ago; now seen by Mr. Thomas for the first time; an abscess has been noticed for the past week; no pain; no tenderness on flexing the well leg to the flexion-test position; no abduction; no adduction; some motion in all directions, limited by muscular spasm.

Case IV.—Female, aged eleven years; began to limp nine months ago; a splint was put on six months ago by a Manchester surgeon, but it is too flexible to be of any use; patient now seen by Mr. Thomas for the first time; abscess noticed two weeks ago; has some screaming in sleep, but no pain otherwise; some tenderness on palpation and manipulation; muscular spasm well marked; no real shortening; one-half inch apparent shortening; adduction, four degrees; flexion, thirty-nine degrees; very little motion in any direction. A new splint was applied.

Case V.—Female, aged nine years. Has limped at times for four years; has not complained of pain; no abscess; muscular spasm well marked; very little tenderness on gentle manipulation; leg one-quarter inch longer than the leg of the opposite side; flexion, thirty degrees; no abduction; no adduction; very little motion in any direction; splint now applied for the first time. I saw the

patient again at the end of a week. The flexion had been completely reduced, and there had been no pain.

CASE VI.—Male, aged nine years; limp and some pain for four months before treatment was commenced; has worn long splint one week; has swelling in the groin, but fluctuation is doubtful; has night-cries; tenderness on flexing the well leg to the flexion-test position; marked muscular spasm; has not yet been allowed to walk; no shortening; no flexion; no abduction; no adduction; motion not tested.

CASE VII.—Male, aged six years; limp and pain for six months before treatment was commenced. Has worn long splint for ten weeks; still has some night pain, but is allowed to walk without crutches; no abscess; some tenderness on flexing well leg to flexion-test position; no real, but one-half inch apparent, shortening; adduction, four degrees; no flexion; motion not tested.

CASE VIII.—Male, aged three years and three months. Has never walked; when three months old had a fall, and splint was put on at once at the Liverpool Infirmary, and was worn for one year; then came under care of Mr. Thomas, and has continued to wear the splint for two years more; no abscess; no pain for a long time past; no tenderness on flexing well leg to the flexion-test position; no real shortening; two inches apparent shortening; adduction, twenty-one degrees; no flexion; motion not tested.

CASE IX.—Female, aged twelve years; limp for six months before treatment was commenced. Has worn long splint for nine months; no abscess; no tenderness on flexing well leg to flexion-test position; no real shortening; one and three-quarters inches practical shortening; adduction, fourteen degrees; no flexion; considerable inward rotation; motion not tested.

CASE X.—Male, aged four years; limp and pain for nine months before treatment was commenced. Has worn long splint twelve months; an abscess appeared soon after splint was applied, and is now near breaking; no pain now; no tenderness on flexing well leg to flexion-test position; no real shortening, one inch practical shortening; adduction, nine degrees; no flexion; motion not tested.

CASE XI.—Male, aged four years; limp for three weeks before treatment was commenced. Has worn the long splint for sixteen months; some thickening in the groin, but no fluctuation can be

made out; no pain; no tenderness on flexing well leg to flexion-test position; one-quarter inch real, and one and one-quarter inches apparent, shortening; adduction, nine degrees; no flexion; motion not tested.

Case XII.—Female, aged fourteen years; limp nine months before treatment was commenced; wore splint for six months before coming to Mr. Thomas, and has continued to wear the long splint for eight months since; abscess was present when she first came under the care of Mr. Thomas; it has never opened, and has now for some time been growing smaller; suffered great pain and could not walk for a long time; no pain now; no tenderness on flexing well leg to flexion-test position; one-half inch real, and one and one-half inches apparent, shortening; adduction, seven degrees; no flexion; motion not tested.

Case XIII.—Male, aged six years; limp for two weeks before treatment was commenced. Has worn long splint eight months; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; no real shortening; three-quarters inch apparent shortening; adduction, seven degrees; no flexion; motion not tested.

Case XIV.—Female, aged six years; limp and pain for six months before treatment was commenced. Has worn long splint two weeks; was unable to walk for the last week before the splint was applied; no abscess; no pain now; some tenderness on flexing well leg to flexion-test position; one-half inch real, and one inch apparent, shortening; adduction, four degrees; no flexion; motion not tested.

Case XV.—Male, aged thirty years; limp for five years before treatment was commenced. Has worn short splint three years; has had eight abscesses; one sinus remains; no pain now; no tenderness on flexing well leg to flexion-test position; two inches real, but only one inch apparent, shortening; abduction, six degrees; no flexion; no motion.

Case XVI.—Female, aged four years; limp for three months before treatment was commenced. Has worn long splint for six months; abscess, noticed four months ago, broke two days ago; has no pain; no tenderness on flexing well leg to flexion-test position; no real shortening; one-half inch apparent shortening; adduction, four degrees; no flexion; some motion.

Case XVII.—Male, aged eleven years; limp and pain for six months before treatment was commenced; wore short splint for two months, since then has worn long splint for twenty months; abscess appeared four months after treatment was commenced, but disappeared without aspiration or opening; no pain; no tenderness on flexing well leg to flexion-test position; one and one-half inches real shortening, but only three-quarters inch apparent shortening; abduction, five degrees; no flexion; motion not tested.

Case XVIII.—Female, aged fifteen years; limp for five months before treatment was commenced. Has worn long splint fifteen months; no abscess; no pain on flexing well leg to flexion-test position; one-half inch real shortening; one-half inch apparent lengthening; abduction, seven degrees; no flexion; motion not tested.

Case XIX.—Male, aged twenty-one years; limp for two years before treatment was commenced; wore long splint three years; after going without splint for twelve months an abscess formed, opened spontaneously, and discharged for six months; during this time a short splint was applied, and has now been worn for eighteen months; no pain; no tenderness on flexing well leg to flexion-test position; one and one-half inches real, but only one-half inch apparent, shortening; abduction, six degrees; no flexion; some motion.

Case XX.—Male, aged four and one-half years; is a remarkably large child for his age; limp for twelve hours before treatment was commenced. Has worn long splint for two months; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; no real shortening or lengthening; one-half inch apparent lengthening; abduction, four degrees; no flexion; motion not tested.

Case XXI.—Male, aged seven years; was hurt by a cricket-ball five weeks before treatment was commenced. Has worn long splint fourteen months; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; no real shortening or lengthening; one-half inch apparent lengthening: abduction four degrees; no flexion; motion not tested.

Case XXII.—Male, aged five years; limp, and pain at times for two and a half months before treatment was commenced. Has worn long splint for two months; no abscess; no pain; slight tenderness on flexing well leg to flexion-test position; no real shortening; one-

half inch apparent shortening; adduction four degrees; no flexion some inward rotation; motion not tested.

Case XXIII.—Female, aged four years; having been cured without deformity or stiffness, relapsed two years after treatment had been discontinued, and has now been wearing short splint two months; one cicatrix; no pain; no tenderness on flexing well leg to flexion-test position; no shortening; adduction four degrees; no flexion; no rotation; slight motion.

Case XXIV.—Male, aged ten years; limp, and pain for six weeks before treatment was commenced. Has worn long splint for six years; has had three abscesses, from which two sinuses remain, and another abscess broke into the intestine; had albuminuria for many months, and was in a very precarious condition; no albuminuria now; is fat and in good color; no pain for a very long time; one-half inch real, and two inches apparent shortening; adduction sixteen degrees; no flexion; no motion. Has walked about for a long time without patten and crutches.

Case XXV.—Male, aged six years; limp for three months before treatment was commenced. Has worn long splint eighteen months; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; slight motion in all directions.

Case XXVI.—Female, aged eleven years; limp, and pain for two years before treatment was commenced. Wore long splint for two years; has worn short splint for one year; no abscess; no pain for a long time; no real shortening; one inch apparent shortening; adduction eight degrees; flexion twenty-five degrees; no motion.

Case XXVII.—Male, aged two years; has had trouble since birth; long splint was put on when four months old; it has been very difficult to keep the patient properly in the splint, and he runs about constantly; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; one-half inch shortening; no abduction; no adduction; no flexion; some motion in all directions.

Case XXVIII.—Male, aged nine years; limp, and pain for seven months before treatment was commenced. Wore long splint for three years; has worn short splint two years; abscess four years ago, and another three years ago; no sinuses; no pain; no tenderness on flexing well leg to flexion-test position; three-quarters inch

real, and two inches apparent shortening; adduction ten degrees; flexion twenty-two degrees; no motion. Lives far away and has been seen but once in three months. Has walked about without patten and crutches.

Case XXIX.—Male, aged fifteen years; limp, and pain for seven years before treatment was commenced; father was consumptive. Wore long splint two years; has worn short splint one year; had one abscess before treatment was commenced; no pain, no tenderness on flexing well leg to flexion-test position. Patient has grown very rapidly and is a very tall boy for his age. One and a half inches real shortening, two inches apparent shortening; adduction four degrees; no flexion; some motion in all directions.

Case XXX.—Male, aged seven years; limp for four months before treatment was commenced. Wore long splint fifteen months; has worn short splint twelve months; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; one-half inch real, and one and a half inches apparent shortening; adduction four degrees; flexion twenty degrees; no motion.

Case XXXI.—Female, aged nine years; strained joint skipping rope; limped, and had pain at times for three and a quarter years before treatment was commenced. Was kept in bed one month before the splint was applied; wore long splint eighteen months; has worn short splint for eighteen months; no abscess; no pain for a long time; no tenderness on flexing well leg to flexion-test position; one-quarter inch real, and three-quarters inch apparent shortening; adduction four degrees; no flexion; some motion.

Case XXXII.—Female, aged ten years; limp for four months before treatment was commenced. Has worn long splint for ten months; has had in-knee of eight weeks' duration, resulting from the use of the splint; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; shortening, and the consequent adduction not measured, because of the in-knee; no flexion; motion not tested.

Case XXXIII.—Female, aged eight years; limp, and some pain for three weeks before treatment was commenced. Has worn short splint for three months—never has worn long splint—but has not been allowed to walk; no abscess; no pain since treatment was commenced; no shortening; no flexion; no adduction; no abduction;

normal motion in all directions; now to be allowed to walk with crutches.

CASE XXXIV.—Male, aged forty-two years; limp, and pain for twelve months before treatment was commenced; no traumatic cause. Has never worn the long splint; has worn short splint for three months; no abscess; no tenderness on flexing well leg to flexion-test position; no pain; no shortening; no flexion; no adduction; no abduction; no rotation; motion not tested.

CASE XXXV.—Male, aged sixteen years; limp for five weeks before treatment was commenced. Has worn long splint for nine months; deep fluctuation in groin; still has some pain; some tenderness on flexing well leg to flexion-test position; three-quarters inch real shortening; no abduction; no adduction; no flexion; motion not tested.

CASE XXXVI.—Female, aged nine years; limp for twelve months before treatment was commenced. Has worn long splint twelve months; small area of deep fluctuation in front of the joint; no pain; no tenderness on flexing well leg to flexion-test position; no real shortening; one-half inch practical shortening; adduction four degrees; no flexion; motion not tested.

CASE XXXVII.—Male, aged fourteen years; limp and pain for three months before treatment was commenced. Has worn long splint for two years; two sinuses in the groin for the past eighteen months; no pain now; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; no motion.

CASE XXXVIII.—Male, aged eight years; limp for fourteen months before treatment was commenced. Has worn long splint for ten months; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; some motion.

CASE XXXIX.—Female, aged eight years; limp and pain for twelve months before treatment was commenced. Has worn long splint three years; first abscess ten months after treatment was commenced, and second soon after first; two sinuses remain; no pain; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; motion not tested.

CASE XL.—Male, aged twenty months; pain and stiffness for six

weeks before treatment was commenced. Has worn long splint ten months; one abscess opened spontaneously three months ago; sinus remains; another abscess now present, pointing in two places; no pain; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; motion not tested.

Case XLI.—Male, aged thirteen years; limp and pain for one year before treatment was commenced. Has worn long splint for one and a half years; first abscess opened twenty months ago, and a second three months ago; one sinus remains; no pain now; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; motion not tested.

Case XLII.—Female, aged fourteen years; limp for three months before treatment was commenced. Never wore long splint; has worn short splint four months; had one abscess; no sinus; has had disease, with abscess at right elbow for eight months; no pain now; some tenderness on flexing well leg to flexion-test position; general condition fairly good; no real shortening; three-fourths inch apparent shortening; adduction three degrees; no flexion; motion not tested.

Case XLIII.—Male, aged thirteen years; limp for three weeks before treatment was commenced. Wore long splint for six years; has worn short splint for two and a half years; was in Liverpool Infirmary nine months at commencement of treatment, not under Mr. Thomas; has had three abscesses; the last closed three years ago; all appeared while under the care of Mr. Thomas; one and a half inches real shortening; no abduction; no adduction; no flexion; some outward rotation; motion not tested.

Case XLIV.—Female, aged eleven years; limp and pain for two years before treatment was commenced. Wore long splint for two years; has worn short splint for one year; an abscess opened spontaneously at about the time treatment was commenced; it closed after discharging for about a year; no pain since that time; no tenderness on manipulation; one inch real shortening; no abduction; no adduction; no flexion; no motion.

Case XLV.—Female, aged nine years; limp for four months before treatment was commenced. Wore long splint for ten months; has worn short splint two months; when three years old wore a Thomas splint, but not under Thomas's care, for ten months; no

abscess; no pain; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; some motion in all directions.

Case XLVI.—Male, aged twenty years; suddenly attacked with pain and limping one month before treatment was commenced; no traumatism. Has worn long splint ten months; no abscess; no pain now; no tenderness on flexing well leg to flexion-test position; one inch shortening; no abduction; no adduction; no flexion; no motion.

Case XLVII.—Male, aged twenty-one years; limp for twelve months before treatment was commenced. Wore long splint for eighteen months; has worn short splint for four years; abscess opened spontaneously before treatment was commenced, and still discharges; no pain; no tenderness on flexing well leg to flexion-test position; one inch shortening; no abduction; no adduction; no flexion; motion not tested.

Case XLVIII.—Male, aged six years; limp for two days before treatment was commenced. Wore long splint for two years; has worn short splint three months; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; three-fourths inch real, and one and three-fourths inches apparent shortening; adduction nine degrees; no flexion; motion not tested.

Case XLIX.—Male, aged six years; limp for three months before treatment was commenced. Has worn long splint for two years; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; leg one-fourth inch longer than well leg; no abduction; no adduction; no flexion; motion not tested.

Case L.—Female, aged eight years; limp for four months before treatment was commenced. Has worn long splint twelve months; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; no motion.

Case LI.—Male, aged three years; limp for five weeks before treatment was commenced. Has worn long splint fourteen months; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; motion not tested.

Case LII.—Female, aged five years; limp and crying in sleep

for two weeks before treatment was commenced. Has worn long splint two months; no abscess; still has crying in sleep, but does not complain of other pain; some tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; motion not tested.

Case LIII.—Male, aged six years; limp for six weeks before treatment was commenced. Has worn long splint for one week; no abscess; no pain; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; motion not tested.

Case LIV.—Male, aged four years; limp and some pain for three years before treatment was commenced. Has worn long splint for three months; no abscess; no pain of late; no tenderness on flexing well leg to flexion-test position; no shortening; no abduction; no adduction; no flexion; motion not tested.

Case LV.—Female, aged eleven years; limp and pain for six months before treatment was commenced. Wore long splint four years; has now been without treatment for two weeks; no abscess; no pain; no tenderness on manipulating leg; no shortening; adduction two degrees; no flexion; slight inward rotation; no motion.

Case LVI.—Male, aged seventeen years; twisted hip kicking football, and was seen next day. Was kept in bed three months without any mechanical treatment; then had the long splint for one year, and the short splint for two years; has had no treatment for the past six months; no abscess; no pain for a long time; pain was very great for a long time at the commencement of the trouble; no tenderness on manipulating the leg; no shortening; no abduction; no adduction; no flexion; normal motion in all directions.

Case LVII.—Male, aged twenty-two years; limp and pain for six months before treatment was commenced; wore long splint for three and a half years; no pain for a long time; cicatrices of six sinuses present; has been without treatment for four months; no tenderness on manipulating leg; three-quarters inch real shortening; one and one-quarter inches apparent shortening; adduction, eight degrees; flexion, thirty-one degrees; no motion.

Case LVIII.—Male, aged three years; limp for two weeks before treatment was commenced; wore long splint thirteen months; no treatment for past three months; no abscess; no pain; no tender-

ness on manipulation; no shortening; no abduction; no adduction; no flexion; considerable outward rotation; all motions, except inward rotation, smooth and free to ninety degrees.

Case LIX.—Male, aged twenty-two years; limp for five years before treatment was commenced; wore long splint two weeks; short splint four and a third years; no treatment for past four months; no abscess; no pain now; no tenderness on flexing well leg to flexion-test position; two and one-half inches shortening; great trochanter two and one-half inches above Nélaton's line; no abduction; no adduction; no flexion; no motion.

Case LX.—Female, aged twelve years; limp for three months before treatment was commenced; wore long splint two years; had five abscesses; no treatment for past three years; one-half inch shortening; no abduction; no adduction; no flexion; some motion in all directions; walks with scarcely any limp, and can go up and down stairs without difficulty.

Case LXI.—Male, aged eight years; limp for four months before treatment was commenced; wore long splint two and a half years; has had no treatment for past year; no abscess; no muscular spasm; no shortening; no abduction; no adduction; no flexion; free motion in all directions to ninety degrees; runs and walks without limp or inconvenience.

Case LXII.—Female, aged twenty years; limp commenced one year before treatment; became unable to walk and suffered great pain; had hemorrhages from the lungs; wore long splint three years; no treatment for past twelve months; general condition excellent; no pain now; no tenderness on manipulation; one-half inch shortening; no abduction; no adduction; no flexion; normal motion in all directions.

From a study of these cases conclusions cannot properly be drawn; but as I have probably given them a more careful consideration than anyone else ever will, I will venture the following suggestions:

Very many of these cases that have had the short splint applied before muscular spasm and pain had subsided and before deformity had been reduced; that have been allowed to walk around without high patten and crutches—that is to say, those whose joints have only been partially immobilized without being protected from the

pressure of superincumbent weight and the concussion of walking, present a moderate degree of adduction, absence of motion, and in a few cases slight flexion, and in one instance in-knee.

On the other hand, those cases that have worn the long splint until cured, that have remained in the horizontal position till all pain and muscular spasm had subsided, and had then used the high patten and crutches, and had had the benefit of intelligent care and nursing, have been cured without flexion or other deformity than the shortening due to actual bone-erosion and arrested growth, and they have shown motion in a very large proportion of cases, and in not a few has there been normal motion.

The absence of any traction-force, either in the line of the shaft or of the neck of the femur, does not seem to have increased the number of patients having abscesses nor the number of abscesses in each case, nor to have increased the frequency of shortening nor the amount of shortening in each case. No case has given any signs of perforation of the acetabulum, either by suppurating track or by the head of the femur, and involuntary muscular spasm and pain arising therefrom are noticeable by their absence. In a word, these patients, who have had no traction, are found to be remarkably free from all those conditions which we have been taught can only be relieved by persistent and long-continued traction.

In conclusion, nothing appears to indicate that the principles upon which Mr. Thomas has based his teaching are in any way at fault, though in practice there is still somewhat to be desired.

DISCUSSION.

Dr. Weigel, of Rochester, N. Y.—It seems to me that a paper of this character can hardly be discussed intelligently without a careful study of the individual cases reported, and that is the reason I do not feel able to present any points for consideration.

There is only one question, with reference to the case where the disease commenced at the age of twenty, that I would like to call attention to. The amount of shortening, I believe, was half an inch. It would be a matter of some interest to determine whether or not the amount of shortening is apt to be as great when the dis-

ease begins in early adult life. I would like to ask what the doctor's experience has been in that regard?

Dr. Reginald H. Sayre, of New York.—I notice that Dr. Ridlon said he had not seen any case where there was evidence of perforation of the acetabulum. I should think that case which discharged pus through the rectum might very possibly be supposed to have perforation of the acetabulum. Of course, it may have been a perforation of the ilium, or a creeping of the pus around the edge of the ilium. Most of the cases I have seen have had perforation of the acetabulum, pus finding an easier road through there than in any other direction.

The case of the man who sprained himself kicking a foot-ball and was put in a splint the next day, I should think would possibly come under the head of a sprain of the hip rather than ordinary tubercular arthritis of the hip-joint.

I agree with Dr. Weigel in thinking that an intelligent discussion of this paper, which is a most interesting one, cannot well be made without examining the details of the cases presented. I am somewhat surprised at hearing that Mr. Thomas allows his patients to walk around without high patten and crutches. I had supposed that one of the great features of his treatment was in keeping the weight of the patient off the diseased joint. I had supposed that that was one thing upon which he laid great stress, and I am not at all surprised at finding the patients treated walking on their feet with joints more or less immobilized, with no traction applied to prevent traumatism, presenting distortions at the end of treatment.

I was very much interested in hearing the report. Like many other reports, it is hard to discuss it with any degree of benefit without looking over it at length and more slowly, because I feel that there are many points which I did not grasp on first listening to it which might be brought out by reading it more carefully. It is a thing that requires a great deal of attention—the question of traction and immobilization, and whether the patient may just as well bear his weight on the diseased joint, as well as the question of avoidance of traumatism to the joint, deserves careful attention. If traumatism is a vast factor in keeping up the diseased joint, and I believe it to be, I should endeavor to remove it; but Mr. Thomas seems to treat his

patients without regard to that factor in many instances. I should think the results would be better in these cases were the traumatism removed. I should think that so far as removal of the traumatism is concerned, when a patient is allowed to walk on his foot, that the old short hip-splint, as applied to the thigh, would be more efficient than a simple fixation-splint in enabling the patient to step upon the lame leg without injuring the joint.

Dr. Arthur J. Gillette, of St. Paul, Minn.—I can say very little in regard to the treatment which the doctor has just given I have never employed any other than the long traction-splint, and I think I can do very much with it. It gives great relief, and it does seem to help the patient. I never get such results as Dr. Ridlon has reported in his paper. I do not remember ever having seen such; but I simply want to report a case which occurred in my practice.

I had a case of hip-joint disease which had existed for about a year. The child had very little pain in the leg, and there was little motion, flexion, and great shortening. About two weeks before I saw it considerable pain was complained of in the other limb near the hip, and the doctor who saw the case advised the parents to come to me. I took the case in hand. I put it on an inclined plane with weight and pulley, as there was considerable flexion. While I was getting a brace made the child had a great deal of pain—more than before. I was not surprised at that, because the child did not keep still. I hoped that as soon as I had the braces applied the pain would be relieved, but it was not relieved when a splint was applied, but grew worse. I kept putting on a little more traction. I worked at the case for six months. In the hip not treated for a year there developed an abscess, and the child began to have more pain in that joint, and the pain in the other was not relieved. I visited the patient daily and tried to build up the child by means of constitutional treatment, and encouraged the mother that the child was getting better, and I was more and more discouraged myself all the time. One morning I went down to see the patient, and found that they had kept letting up on the perineal straps, which allowed the splint to go clear up above the rim of the pelvis and the foot-piece was against the bottom of the foot. I proceeded to deliver a lecture, and after all I had said in condemning the position of the child, etc.,

they said it had not had a particle of pain. I was so much disgusted that I left the house and told them I would not return.

After receiving a reprint from Dr. Ridlon I looked up the case. The patient was kept in this position with the leg to the splint, and the child has not had one bit of pain since. I stopped treatment. Of course, I want to say that this was the only case I ever found where traction seemed to give pain. In other cases pain has been relieved by the use of the long splint.

Dr. Samuel Ketch, of New York.—The subject of the treatment of hip-disease was thoroughly discussed at the last meeting of this Association. Regarding the merits of splints, I do not wish to say anything; but I confess my inability to see exactly the object of Dr. Ridlon's report. The cases in themselves are interesting, but we cannot accept the report as final concerning Thomas's methods, from his own statements. He says the principles were not carried out, and I am afraid if anything does happen to these cases the doctor has reported, that an excuse can be offered that they were not treated according to Thomas's ideas. So, with Drs. Weigel and Sayre, I agree that there are none of us in a position to discuss the paper intelligently. If Dr. Ridlon follows out these cases until cured, and then gives us a report, which no doubt he will be able to do, I think we can intelligently discuss the subject.

Dr. Ridlon.—I realize the truth of what Dr. Ketch has said. I presented this report for the reason that I thought it might be of interest to show the work of a man of whom we have heard so much, and one whom only a few of us have seen; that is my excuse for reading the paper.

As to not following out the principles which have been laid down, Mr. Thomas is simply in the same position that we all are when treating the dispensary class. We know well that the treatment is not carried out in an ideal way. Dr. Ketch, in his dispensary practice, does not do it any more than anyone else. He applies a long traction hip-splint, and makes traction to the extent that he thinks fit. But when the patient begins to walk, the same accuracy of fit of splint, the same nice adjustment of the hip-band, the same tension of perineal straps is not maintained. Many cases that ought to lie down, are not kept so, and they go about walking on the foot

when it ought to be suspended. That is just the condition of things in the cases of Mr. Thomas. The patients are poor and ignorant, and not easy to control. But, in a few cases, the results are exceptionally good.

It is true, as Dr. Sayre has said, that one of the chief principles of Thomas's treatment is not to allow the patient to walk on the foot of the affected leg. But I saw case after case walking on the diseased leg, and he finds that in a certain class of ignorant people it is impossible to make them use crutches and pattens. He did the best he could with the cases in hand, and that is the only excuse for walking on the leg. He does not want them to do it. He would be glad to keep them lying down for some length of time, or as long as the joint was sensitive. But this is often impossible of accomplishment.

As to the foot-ball case which Dr. Sayre referred to, I was inclined to think the same way. I do not know but he is right; still, as the case went on and got no better after three months' rest in bed with external applications, and then had to have mechanical treatment for three years, I was led to think it was tubercular.

As to the short hip-splint, if the patient has to walk around on the leg, I should be inclined to agree with Dr. Sayre in a measure. Dr. Sayre, senior, told me a short time ago that he used to get beautiful results in using the old short splint—better than in the use of the long one. There is this to be said about it: in using the old short splint, if the patient walks on the leg, he does not get the push-and-pull action which he does get in walking with the long splint. If I wanted to use a portable traction-splint on the average case of hip-disease, I should be inclined to use a short splint. The reason why Dr. Sayre gets good results when he uses the short splint may be because he avoids some up-and-down motion at the joint.

I agree, too, with Dr. Sayre that the abscess, breaking into the bowel, probably had perforated the acetabulum.

As to shortening later in life, I attribute shortening in these cases to bone destruction and to arrested growth. When hip-disease comes on late in life, other things being equal, we ought not to get so much shortening as when it commences in infancy. In the one case where there was two and a half inches shortening, however, the patient was an adult. So that, in so far as these statistics go, it does not hold. The point, however, is well taken, that we ought to get less shortening in these adult cases.

LATERAL DEVIATION OF THE SPINE AS A DIAGNOSTIC SYMPTOM IN POTT'S DISEASE.

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Lateral deviation of the spinal column as a symptom of Pott's disease, up to the present time, has been allowed very little significance or importance. Rarely spoken of at all, when it has forced itself upon the attention it has been considered as an occasional symptom of no especial significance, occurring rather uncommonly, and as probably due to the wearing away of the vertebral bodies more on one side than on the other. The only article which deals with the subject at all as its importance warrants is the one by Dr. Bartow, in the *Annals of Surgery* for July, 1889, to whom I am indebted for most of my ideas in the matter. He called attention to the existence of lateral deviation of the spine in most cases of dorsal and lumbar Pott's disease, insisting particularly upon the presence of rotation of the spine. And he made the characteristics of the deformity very plain by a series of admirable illustrations.

In the last nine months I have examined with regard to the existence of lateral deviation nearly every case of Pott's disease that I have seen, and I have been able to secure detailed and accurate measurements of some thirty cases. It is the results of these observations that I shall have the pleasure of briefly presenting to you.

The striking fact that at once presented itself in the observation of these cases was that lateral deviation of the spine was amazingly common. In fact it seemed, in all stages of the disease, to be almost universal in some degree, the notable exception being cases that were progressing particularly well under conservative treatment, and certain cured cases where evidences of active disease had ceased.

But in the cases taken as they came first to the clinic, before treatment was begun, the presence of lateral deviation was universal.

Cases of cervical disease showed the least characteristic deformity; although inasmuch as the head was generally held obliquely to one side or the other, a certain compensatory twisting of the trunk was necessitated, but it lacked the characteristic features of the deviation when the disease was lower down in the spinal column.

I am aware that in asserting that a perceptible degree of lateral deviation of the spine is a uniform symptom of early dorsal and lumbar Pott's disease, I run the risk of awakening scepticism, and I can only ask that you will carefully examine cases with this in view. The kyphosis, the antero-posterior curvature, is so much the more important matter that attention is apt to be directed solely to that, and lateral deviation naturally enough escapes attention, except when it is so severe that it becomes difficult to fit a brace or the attitude is notably unsymmetrical.

But if the child be stripped and inspected from in front, when standing as squarely as he can hold himself, it will be found that a perceptible degree of deviation of the spinal column is present. On account of the sharper and more definite outline which the front aspect of the body presents, any deviation is much more noticeable to an observer standing in front of the child than when behind him. So that when from behind it seems scarcely noticeable, from in front it becomes a marked deviation of the whole trunk.

The characteristics of the deviation are not like those of rotary lateral curvature. The whole aspect of the trunk is different; it has not so much the look of a sinuous distortion as of a distinct leaning of the body to one side or the other. Rotation is not a prominent factor.

In the larger number of cases, for some reason or other, the inclination of the trunk is to the right rather than to the left, although not overwhelmingly so. Possibly it may be associated with the more constant use of the right arm.

This lateral deviation would seem to be one of the earliest symptoms of Pott's disease. In two or three of the cases observed it was distinctly recognizable when the other symptoms were slight and ill marked, and was associated with a very slight degree of muscular

rigidity, which alone would have been altogether insufficient to establish the diagnosis of Pott's disease.

By the kindness of some of my assistants at the Children's Hospital, particularly Dr. Goldthwaite and Mr. Lund, I have been able to measure accurately some thirty cases of Pott's disease, which were taken consecutively as they came to the out-patient clinic, and were not selected for the existence of lateral deviation, or for any other reason. They represent unselected cases, mild and severe, at all stages of the disease.

The apparatus by which the measurements were taken was a very simple one, consisting of an elastic steel pelvic band which was buckled about the pelvis at the level of the anterior superior spines, and to the middle of this at the back just over the sacrum, was attached by a pivot a movable steel upright which could be placed in the line of the deviated column, and its divergence from the perpendicular noted on a graduated arc attached to the pelvic band. Rotation of the spinal column was measured by a horizontal arm revolving on this upright, the two ends of which were placed against the ribs, and the deviation of the plane of the chest from that of the pelvis was read on another graduated arc.

In all of these thirty cases, with one exception, the deviation was enough to be easily measured by the instrument, reading in degrees. In the one case mentioned, although asymmetry was perceptible, it was so slight that the instrument did not record it. In no case was a lateral deviation of more than eight degrees from the perpendicular found, and that was so much of a distortion that it seemed as if the children would lose their balance and topple over sideways in walking. In only four cases of the thirty was there as much divergence as eight degrees, and even this must be an accidentally large proportion of such severe instances of the deviation.

A divergence of five or six degrees was decidedly noticeable, so much so that it gave decided difficulty in fitting braces on account of the inequality of the two sides when the child stood up. Cases which were progressing well showed only a divergence of two or three degrees, which would not be noticed except on careful inspection, but which is enough to be distinctly perceptible when the child is regarded from in front without his apparatus.

Of course, it is purely arbitrary to speak of the matter in degrees

as measured by this instrument; but it serves as some sort of a standard in the comparison of cases, and it afforded the means of keeping record of the progress of individual cases.

A particular interest attached to the question of rotation in connection with the lateral deviation. It was easily measured by the horizontal arm of the apparatus; but it proved to be a variable and uncertain affair, following no especial rule, but present to some degree in the majority of cases of Pott's disease in connection with the lateral deviation. It was never very marked, not being in any way comparable to the rotation of true scoliosis; and in no case had the column rotated through an arc of more than seven or eight degrees. This was, however, enough to be distinctly noticeable.

The most interesting fact about the rotation was the fact that it did not follow the same rule as in scoliosis—that is, rotating backward on the side of the convexity of the curve. More often than not it did follow this rule, but in at least a third of the cases measured it rotated in the other direction. One would expect to find in a large dorsal curve to the right that the right side of the chest had rotated backward, but in these Pott's disease cases it was just as likely to have rotated forward without disturbing the symmetry of the lateral curve.

As a check to the observations made on lateral deviation as occurring in Pott's disease (to anticipate the possible criticism that a common asymmetry of the growing body had been mistaken for a pathological condition), I was enabled to have measured in this regard one hundred healthy boys from one of the city institutions, by the kindness of the Post Physician, Dr. Coggswell. These boys were all stripped, and carefully measured by Mr. Lund, who had taken most of the pathological measurements under my supervision. The same apparatus was used as that which was employed in the pathological measurements.

These boys were from nine to fifteen years old and may be taken as representatives of healthy, well-developed boys in general. Sixty-two were perfectly symmetrical, two had short legs from injury, and were not counted. Thirty-six showed slight but perceptible asymmetry, in only three cases reaching as much as four degrees; most of them showed only one or two degrees of lateral deviation, which would not be noticeable when they were dressed, and even when they

were stripped would escape any but the closest inspection. An interesting point, however, in this connection was that slight rotation was a constant accompaniment of the lateral deviation, and followed the same rule as in scoliosis, cases with a right dorsal curvature showing a backward rotation of the right side of the chest.

To return once more to the lateral deviation in Pott's disease. The symptom is much more noticeable in the standing than in the lying position, in which it becomes very much diminished or disappears only to reappear again when the patient stands on his feet. It is this variation in the deformity which makes it so difficult to apply a brace to a child who has this lateral deviation severely. The brace may fit perfectly when the child lies on his face, but in the standing position it may be thrown so markedly to one side that it fails to afford the proper support.

Although in certain cases, especially the late ones, the distortion is undoubtedly due to the unilateral destruction of bone, it is in general a symptom of muscular irritability. Often associated with a severe degree of pain, it is to be regarded as analogous to the distortion of other diseased joints. Just as in hip-disease, for some unknown reason, the irritation of the diseased joint-surfaces produces a reflex muscular spasm of the muscles controlling the joint, and the leg is stiffly held in a position of adduction. So in Pott's disease undue irritation of the inflamed intervertebral articulations causes rigidity of the columns and lateral distortion.

That it is a phenomenon of this sort in most cases is shown by the fact that it tends to disappear in the recumbent position, that it increases progressively if the children go about without proper support, and that it improves so rapidly under suitable treatment that the idea of a structural cause for it is not tenable in most cases.

Two cases which I have recently had the opportunity of observing very closely will serve to show how rapid is the disappearance of the deformity under favoring conditions.

A girl of ten appeared at the Children's Hospital with a lateral deviation of eight degrees occurring in dorsal Pott's disease, being an exceptionally severe case. She was put to bed, with weight and pulley extension to the spine, and weekly measurements were taken in the standing position. The deformity diminished progressively

from the first, and in five weeks has been reduced from eight to two degrees, which is an amount scarcely perceptible.

A boy of five, seen at the same time, with an equal amount of deformity, was treated in the same way at the Samaritan Hospital, and after five weeks of recumbency and extension showed a reduction of the deformity from eight to three degrees.

These cases were treated so long by recumbency, not because it was entirely necessary, but in order to note the rapidity of improvement under the most favorable conditions.

It thus would seem proper in most cases to class the deformity as an irritative muscular symptom rather than as a unilateral loss of bone, and to treat it in the same manner that one treats the malpositions of other irritated joints. The rapidity with which it responds to the sedative measures of fixation and, perhaps, traction, applied to the seat of the disease, is the strongest advocate for this sort of treatment.

Treatment by recumbency and extension to the spine (applied by means of weight and pulley extension to both legs and a Sayre's head-sling pulling also by a weight and pulley from the head of the bed) is undoubtedly the quickest and most efficient method of reducing the local irritation and with it the deformity; but it is a method which is not always available or acceptable, and the deformity is not one which requires such radical and immediate measures as impending paralysis or threatened abscess. So that although the deformity may be most quickly reduced in that way, efficient treatment by braces or jackets will, in most cases, suffice to accomplish the same end more slowly. In all the cases observed no class showed so little lateral deviation of the spine as those cases which were progressing favorably under treatment by the Taylor back-brace.

The objection to the treatment of these cases by a brace has been already stated in the difficulty of accurate adjustment. In even the worst cases, however, by special pains the brace can generally be made to afford efficient support if the two uprights be bent to fit the different curves of the two sides of the back.

The plaster jacket affords a still readier means of correcting the deformity. Suspension diminishes or effaces the lateral deviation, so that by the application of a series of accurately-fitting jackets a comparatively normal position is restored to the spine.

The method of Dr. Bartow is more rapid and equally efficient; a leather jacket is shaped to a corrected cast of the deviated trunk, and a comparatively straight jacket applied to the distorted column.

From the efficiency of these methods it must be evident that treatment need not necessarily be addressed to the lateral deformity as such. Any measure which modifies the pressure of the diseased vertebræ and fixes the spinal column tends to quiet the local irritation, and acts as a corrective measure to the disease and all its symptoms, including the lateral deviation. In a word, the treatment of Pott's disease is the treatment of the lateral deformity. In the severest cases, however, the importance of recumbency and extension cannot be over-estimated.

In attempting in some way to sum up what I have tried to call to your attention it is first necessary to insist upon lateral curvature of the spine as an exceedingly common, if not a uniform, symptom of Pott's disease in the lumbar and dorsal region. This deviation is generally accompanied by a certain amount of rotation, which does not follow the same rule as in scoliosis.

The lateral deviation is, for the most part, a symptom of muscular irritation, reflex to joint inflammation, and belongs to the same class as the malpositions of other diseased joints. It yields readily to treatment, and is most rapidly reduced by rest in bed and spinal extension, although the ordinary treatment of Pott's disease is generally sufficient to overcome the lateral deformity if efficiently carried out.

Finally, I would call your attention to the importance of extending and verifying these observations, in the hope of adding, in lateral deviation, a new and simple diagnostic symptom by which the early detection of Pott's disease may be rendered less difficult.

DISCUSSION.

Dr. James K. Young, of Philadelphia.—The valuable paper of Dr. Lovett has greatly interested me. I have experienced the same difficulty that he speaks of in fitting apparatus to the cases in which there is marked rotation in Pott's disease. With him, I believe that in

the majority of cases the trouble is of muscular origin. I have seen one or two cases in which I am still under the impression that it was due to osseous change. There had been a considerable amount of destruction of the osseous tissue, which was permanent. The treatment which I employ is similar to that proposed and used by Dr. Lovett; but the cases to which I refer, notwithstanding their treatment, have still remained rotated, and the same difficulty has been experienced in fitting the apparatus.

Dr. Reginald H. Sayre, of New York.—No one can observe a large number of cases of Pott's disease without noticing the deviation of which Dr. Lovett has spoken, although there are certain cases where it is due to the same cause which produces the antero-posterior curvature with which we are so familiar, namely, destruction of bone; nevertheless, in a number of instances it is a distortion due, I believe, to muscular spasm, such as we have in disease of other joints, and disappears when that spasm is allayed. In many instances in putting on jackets on these cases with this lateral deviation, I have noticed that, unless I was very accurate in applying the jacket, the lateral deviation still remained; and, after a while, on removing the jacket and putting on one that fitted better, which gave the spine more accurate support, which put the inflamed surfaces in a position of rest, that that lateral deviation disappeared, to recur again when the jacket failed to give proper support, or when I put on a new jacket which was not accurately adjusted. In one case I have seen a position of the spine which very much resembled true scoliosis—so much so, that for a day or so I was in doubt whether it was scoliosis or a case of Pott's disease; but in only one case have I seen a distortion of that character. That distortion, I believe, was due also to muscular spasm; and it is an additional argument for the opinion which I held yesterday, that in true idiopathic scoliosis, in certain cases, it was a spasm, or, I might better say, inequality of action between the intrinsic muscles of the spine, which produced the characteristic defermity.

Dr. Samuel Ketch, of New York.—I am sure we are greatly indebted to Dr. Lovett for presenting so concise and clear a statement of this subject, which, though well known to us all, and which

has been spoken of before, has never received the attention that it merits.

There is one thing which, undoubtedly, Dr. Lovett has seen himself, as well as have others, and that is this: In the course of Pott's disease, at times there occurs a lateral deviation which marks an access of all the symptoms and exacerbations, and it is interesting to know that as the exacerbations are overcome the lateral deviation disappears. I do not know whether Dr. Lovett specially referred to that or not. It is undoubtedly a clinical fact.

Concerning the question Dr. Young raised about the permanence of the rotation, I have seen several cases that became permanently scoliotic, so to speak, although they were cases of Pott's disease. They were cases I had seen very late, and never had any efficient mechanical support. I think it would be a rarity to find permanent lateral deviation in a case of Pott's disease which has received sufficient treatment by mechanical support.

Dr. A. J. Steele, of St. Louis.—If the destruction were greater on one side than on the other, we would have a lateral deviation which would be permanent.

Our thanks are due to Dr. Lovett for calling our attention to the causes in the great majority of cases of this lateral deviation.

Dr. Ketch.—The cases I refer to have been cured in a bad position—in other words, ankylosis has occurred and caused permanent deformity.

Dr. Ap Morgan Vance, of Louisville, Ky.—I wish to thank Dr. Lovett for his very interesting paper. I have been puzzled many times in trying to overcome this tendency to lateral deviation. I think it is often one of the earliest symptoms. We can make a diagnosis often from it alone. There is muscular spasm on one side. I think, probably, the tendency to this position is brought about by the fact that, during the earlier stages, children are in the habit of resting themselves by placing their hands upon the hip or knee. I think, also, the tendency to lateral deviation is often produced by the fact that the integrity of the limbs is more or less interfered with early in some cases. Probably it is a nerve involvement and the child stands with one limb slightly flexed, as it may

be painful to stand with it straightened. The early tendency of these patients to have lateral curvature or deviation confirms it.

Dr. Young.—The cases to which I referred were cases which had gone through their course and had become ankylosed in the rotated position.

To illustrate this, I have also seen a case of cervical caries in which the vertebræ were ankylosed in a false position.

Dr. A. J. Steele, of St. Louis.—I would like to ask whether the nerve supplying the joint also controls the muscles and skin over the joint, and why we have contraction on one side and perhaps not on the other?

Dr. Charles L. Scudder, of Boston.—It seems to me that the real value of Dr. Lovett's paper has been overlooked. Each one has thanked him for calling attention to this quite commonly observed condition of lateral deviation and rotation occurring in the course of cases of Pott's disease. I want to thank him for presenting an accurate measurement of this condition. He has given us a valuable record which will remain permanent, and his method of recording these cases should be used in the study of the early stage of Pott's disease.

The more nearly all observations upon disease of the spine are reduced to a scientific nomenclature, the more accurate and valuable will be our knowledge of the obscure cases. Progress is to be made in all departments of orthopedic surgery in proportion to the adoption of accurate methods of recording cases in all their details. Dr. Lovett's paper is a step in the right direction.

Dr. Lovett.—In hip-disease, from some unknown reason, inflammation of the joint excites muscular spasm and causes fixation of the joint even in a malposition, although there is no evidence to establish the fact that this deviation is a muscular affair, beyond the fact that it disappears so readily under treatment. It seems fair to assume that lateral deviation in Pott's disease belongs to the same class of reflex phenomena; that is to say, in certain cases it is undoubtedly due to a wearing away of the bodies of the vertebræ more on one

side than on the other—a class of cases I did not intend to pass over. But in the majority of cases, as I have seen them, especially in the early cases, it was purely a muscular phenomenon, caused by muscular contraction, and was not a grave affair.

I, perhaps, did not lay stress enough on the diagnostic importance of it in these cases, which is considerable. In several cases it has been practically the only symptom on which one could really make a diagnosis of Pott's disease. The muscular spasm of the back was slight; there was no kyphosis; no psoas contraction; and the only symptoms were marked lateral deviation, with elevation of temperature. In two or three cases of this sort which I have seen in the past year, the other symptoms have come on markedly afterward. If it falls in with the experience of other members of the Association that lateral deviation is a uniform symptom of Pott's disease, and one that we can rely upon for diagnostic purposes, one point will have been gained in the early diagnosis of the disease which should be of practical importance.

THE DISEASES OF THE EYE ASSOCIATED WITH CARIES OF THE VERTEBRÆ.

By JAMES K. YOUNG, M.D.,
PHILADELPHIA.

The diseases of the eye associated with caries of the spine are, from necessity, of the same pathological nature—strumous or tubercular.

The occurrence of ophthalmic affections in certain cases of spinal caries has frequently been observed, and the direct association has been frequently noted. It is impossible, in this connection, to sketch the more important lesions met with; suffice it to mention the various affections, pointing out those which have a particular significance bearing upon the relationship existing.

Among the most frequent diseases affecting the lids and lachrymal apparatus, are the various forms of conjunctivitis (acute and chronic), eczema, lupus or *scrofulide tuberculeuse*, and dacryocystitis. Of these, lupus is one of those lesions which may be the only evidence of a tubercular condition, and although its tubercular nature has been doubted by Kaposi for well-known reasons ("because of the paucity of the bacilli in the morbid changes; the non-appearance of general tuberculosis in the same individual after a long duration of the lupus; the impossibility of multiplying lupus by inoculation, and the almost universal immunity from lupus of other members of the same family"[1]), anatomically it contains tubercle-bacilli, and tuberculosis can be reproduced by its inoculation. The presence of lupus is peculiarly significant of struma.

Affecting the anterior portion of the globe are those peculiarly interesting affections—phlyctenular disease and phlyctenular keratitis,

[1] Jacobi: Keating's Cyclo. of Dis. of Children, vol. ii. p. 173.

with their periods of exacerbation and improvement—almost peculiar to the strumous diathesis. Hypopium keratitis, ulcus corneæ serpens as the result of dacryocystitis, episcleritis, scleritis, sclero-keratitis, and even staphyloma of the sclera, are met with as direct evidence of a scrofulous diathesis.

Particularly significant in this portion of the eye is the so-called iritis serosa, formerly known as descemitis, a strumous lesion of the iris, involving frequently the ciliary body and deeper structures; and tubercles of the iris, or, as it was formerly called, *granuloma.* The former affection, or scrofulous iritis, as Vernon[1] called it (retaining the name employed by Mackenzie and others), has not received in late years from ophthalmologists the attention it deserves. In fact, Vernon has spoken particularly of the unsatisfactory and inexact state of our knowledge as regards tubercular affections of the eye in his former paper.[2]

The nodules attached to the iris in this disease upon microscopical examination have been found to consist of "small nucleated cells, with many free nuclei, and a very scanty intercellular stroma, with *débris* of cells, but without bloodvessels or pigment." These cases cannot be classed under the category of iritis as generally observed, on account of the early age at which they make their appearance, the futility of therapeutic measures, and the danger to life.

The true tubercular affection resembles somewhat the serous iritis in general course, symptoms, etc., and may even terminate in the destruction of the globe. The tubercles of the iris found in this disease, and formerly described as granuloma, differ, however, essentially from the nodules found in serous iritis, but their true nature is perfectly identified by recognizing the characteristic bacilli.

The posterior portion of the eye, or deeper structures, are less frequently affected, and when diseases do occur as primary lesions, they present no distinctive features. Among these may be mentioned tubercles of the choroid as a result of general miliary tuberculosis, and especially of tubercular meningitis, and choroido-retinitis, alone or associated with optic neuritis.

It will be observed in this enumeration of the diseases of the eye

[1] Vernon: Brit. Med. Journ., 1874, vol. ii. p. 276.
[2] St. Barth. Hosp. Rep., vol. vii.

associated with spinal caries that the majority, and certainly the constant ones, are all of the strumous or tubercular nature, and this introduces us to the relationship of these two conditions and the significance of these diseases to the osseous lesion progressing within. Referring to the relation between scrofula and tubercle, Treves has given the following conclusions:[1]

1. The manifestations of scrofula are commonly associated with the appearance of tubercle, or, if no fully-formed tubercle be met with, a condition of tissue obtains that is recognized as being preliminary to tubercle. *Anatomically*, therefore, scrofula may be regarded as a tuberculous or tubercle-forming process.

2. The form of tubercle met with in scrofulous diseases is usually of an elementary and often of an immature character; whereas, in diseases called tuberculous in a strict clinical sense, a more perfect form of tubercle is met with in the form of the gray granulation or adult tubercle (Grancher).

3. Scrofula, therefore, indicates a milder form or stage of tuberculosis, and the two processes are simply separated from one another by degree.

Accepting this view, there is, in other words, in scrofulous persons a constitutional predisposition to caseation, or a tuberculosis of irritated parts. When the bacillus tuberculosis is actually present in the diseased area, scrofulosis has been succeeded by tuberculosis. In etiology most of these diseases of the eye are scrofulous rather than tubercular, possibly from the fact that, being more superficial and accessible, attention is earlier directed to them.

In this connection it is interesting to observe an antagonism, not absolute, but tolerably well established, which seems to exist between the external and internal tubercular processes. This is why phthisis is not more frequent in subjects of hip disease; why subjects with external cervical gland disease are not more often attacked with pulmonary tuberculosis, and why subjects with angular curvature (caries of the vertebræ) are not more commonly attacked by it. It is because of this apparent antagonism that exists between the tubercular diseases that it is, moreover, unusual for two grave manifestations of scrofula to be active at the same time—one will become manifest,

[1] Scrofula, etc., London, 1882, p. 21.

while the other is observed to improve or subside. This observation is particularly to be noted in the associations under consideration. It is common to observe the ophthalmic diseases improve or subside altogether while an exacerbation of the osseous affection supervenes, and *vice versa*. It may be considered, then, as established that the majority of cases of spondylitis are tubercular; that the etiology of these diseases of the eye and of the caries is the same (*i. e.*, insufficient diet and infection), and that they are both liable to exacerbations. These facts taken together have a peculiar significance, and indicate a prophylaxis and a necessity for treatment which might otherwise be overlooked.

There is constantly going on in the economy a warfare by the active, healthy cellular structures which compose the human organism against the invasion of parasites. Whether the claim of Metschnikoff be accepted, that the degeneration of the bacilli (which has long been known to occur within the giant cells) results directly from their phagocytic action; whether the statement of Baumgarten be admitted, to regard the relation of the giant cells to the bacteria as one of the strongest evidences against the theory of phagocytosis, or whether the agnostic expression of Osler be taken as the present state of our knowledge, the indication to employ both constitutional and local treatment deserves emphasis.

In conclusion, if this short paper convert but one practitioner to the importance of treating all localized tubercular lesions with constitutional as well as local treatment, the object for which it was written will have been accomplished.

By way of summary, then:

1. The diseases of the eye associated with caries of the vertebræ are scrofulous or tubercular, the difference being principally in degree.

2. Scrofulosis may be considered the constitutional predisposition to caseation; tuberculosis, the same condition infected with bacilli tuberculosis.

3. Both the lesions of the eyes and the caries of the vertebræ yield more readily to a combined constitutional and local treatment.

POSTERIOR RACHITIC CURVATURE OF THE SPINE.

By SAMUEL KETCH, M.D.,
NEW YORK.

It would be invidious on my part to bring before this body the description of such a well-known deformity, were it not for the fact that its clinical significance has, in my experience, been so often misunderstood. Believing, as I do, that one of the functions of the specialist is the diffusion of knowledge relating to his own particular line of work, and that this Association is a centre for such dissemination, I have taken the liberty of bringing the subject of Posterior Rachitic Curvature of the Spine before you.

Of the several deformities of the spine, whose underlying cause is found in the condition known as rachitis, the ones most commonly seen in practice are the lateral and posterior. With the first class, namely the scoliotic, I shall not deal here, except to state that generally they are developed at a later period than the curvature, the subject of this article.

The etiology and pathology of posterior rachitic curvature of the spine are essentially those of rickets in general, the deformity being simply one of the local manifestations of a general diathesis. The causation, to my mind, is largely mechanical, and is furthered by such movements tending to throw the weight of the body on the weakened vertebræ and their appendages. Rachitis of the vertebræ evinces itself, as does rachitis, usually at a very early period of life, by an irregularity in the processes of ossification, by cartilaginous enlargements, and by a marked diminution of the harder substances entering into the bone formation, notably the lime salts. In consequence of this unstable condition of the rachitic vertebræ, we find in the long axis of the spinal column many soft places, in some cases including the upper and lower surfaces of all of the vertebræ, in others

localized to a few. Thus the physiological firmness of the column being markedly weakened, we find a more or less extensive curvature present, depending on the number of vertebræ involved. It must not be forgotten that the other tissues, the muscles and ligaments necessary to the integrity of the column, are also involved in the rachitic process, and by their weakened action also add to the formation of the deformity.

With these few words regarding the anatomico-pathological factors, I shall at once proceed to a consideration of the clinical features, with which it is intended that this paper shall principally deal. I am quite certain that most every surgeon has at times been puzzled by the occurrence of a case which united in a marked degree the symptoms of both a rachitic kyphosis and one of inflammatory origin due to caries of the spine. It has been stated that, as a rule, the rachitic curve is a general one, embracing the whole length of the spinal column, and that a differential diagnosis in these cases was not a difficult one. However, in looking up the cases presenting at the New York Orthopedic Dispensary, I have found that the majority show a limitation of the curve to the dorso-lumbar spine, a very favorite position for the occurrence of Pott's disease. United with the localized curvature, we often have associated symptoms which closely imitate those presenting in the inflammatory cases. Thus, in addition to the deformity, we may have, in greater or less degree, pain, spinal rigidity, a pseudo-paralysis, or any of the distinctive symptoms relating to the area of disease. The pain of caries of the spine is usually so characteristic, and in the dorso-lumbar region so uniformly anterior or antero-lateral, that apparently error regarding this symptom would seldom take place. It must be remembered, however, that patients the subject of rachitic kyphosis are usually very young, from one to three years old, and that they are unable to locate their sufferings accurately. That pain is not an unusual symptom in rachitic children is a well-known fact, and in many instances so acute as to prevent any handling of the patient. It is, however, general in character, and expressed by touching any part of the body, not being limited to any circumscribed spot. Again, this pain may so interfere with the muscular expression of the disease, the patient involuntarily stiffening up on attempts at examination, as to obscure the normal flexibility, and thus deprive us temporarily of

a valuable diagnostic sign. In most cases of rachitic kyphosis the deformity partially or entirely disappears on placing the patient in the prone position, and there is an entire absence of that sharp reflex muscular spasm, so characteristic on motion, and only found as the result of inflammatory bone disease. The stiffness met with in rachitic curvature due to pain, may be overcome by gradual force, after allowing the patient to keep in one position for a time. Nothing short of anæsthesia will overcome the reflex muscular spasm of the bone trouble. Again, where we have a caries in the dorso-lumbar spine, we are, as a rule, able to demonstrate the presence of either unilateral or bilateral psoas contraction, which in my experience never occurs in the purely rachitic curvature. As before observed, there are cases of rachitic curvature which do not entirely disappear in the prone posture, but they are generally seen in old cases of rickets, where organic change has occurred, and are unaccompanied by muscular spasm or pain. It is not intended that this paper shall deal with either the posterior curvatures of adolescence or old age.

In connection with the rachitic deformity, we are often confronted with a condition of muscular weakness, so pronounced as to simulate very closely the paraplegia met with in Pott's disease. The child may already have begun to walk, when suddenly it begins to get weak in its lower extremities, and this is soon followed by an entire inability to stand. The child is "taken off its legs," or "has lost its walk," the mothers say. In other cases the child has never stood alone, nor does it make any attempt to walk. The patient, on being examined and the curvature discovered, in connection with the supposed paralysis, grave apprehensions of organic spine disease are entertained. That this pseudo-paralysis is not uncommon, and may be very deceptive, is proven by the fact that Berg has seen it often enough to write a monograph on the subject. This muscular weakness is not a localized one, being but another symptom of the general condition. It gives none of the characteristic electrical reactions of a true paralysis, nor do we find the consistent exaggerated tendon-reflexes accompanying a pressure-paralysis. Again, it is a rare thing for a paraplegia to accompany a caries of the spine when the disease is located in the dorso-lumbar region, the favorite position of a posterior rachitic curve. It is always a puzzling symptom, how-

ever, and well calculated to deceive the inexperienced or superficial examiner.

I have attempted, in rather a cursory manner, to show the identity of some of the symptoms met with in posterior rachitic curvature, and also Pott's disease of the spine, and have also endeavored to demonstrate briefly the more important differential points. In closing this part of the paper, I should state that the presence of a rachitis does not preclude the simultaneous existence of a caries of the vertebræ, and that such cases are not infrequently observed. Lastly, the examination of the entire body for evidences of rachitis should never be omitted, for in the enlarged skull, beaded ribs, flattened epiphyses, etc., valuable testimony is afforded toward a diagnosis of posterior rachitic curvature.

I know of no class which are, as a rule, so amenable to treatment, and in which such grateful results may be obtained, as in those under consideration.

But, I should like to protest right here against the very extensive prevalence of the opinion so often given by medical men, and especially in connection with rachitic deformities, that patients will "grow out of" them. Undoubtedly some cases do get well without apparent treatment, but I do not think that we are, as yet, in the position when we can tell positively which cases will and which will not recover in this manner; and until such time of accurate prognosis arrives, the patient deserves the benefit of the doubt. Again, these are the class of cases in which we almost always promise a recession of the deformity, and I think that some of the marvellous cures of supposed organic kyphoses the result of caries, were in reality puzzling cases of posterior rachitic curvature.

The treatment of posterior rachitic curvature is best embraced under three headings, namely, the general, postural, and mechanical or local, in most cases a combination of the three being advisable. Under the head of general treatment are included the hygienic, dietetic, and medicinal agents employed. I will not detain you by a lengthy account of any especial agents, as they are more in the province of the medical attendant, and undoubtedly well known to you. I should like to state, however, that my main reliance has been placed in sunlight, fresh air, the patient being in the recumbent posture,

and on phosphorus and cod-liver oil internally, as well as inunctions of the latter.

In very young children, from one to two years old, I never advise the use of mechanical supports. The tissues of these patients are so unstable that any pressure is apt to be badly tolerated, and bad sloughs are easily produced. In this class the constant recumbent position, with fresh air and sun-baths, together with internal treatment and close attention to the diet, is usually sufficient.

In all cases the condition of the bowels, the urine, and the skin should be carefully inquired into. When the children are somewhat older, and beyond the more acute stages of the malady, the question of mechanical support becomes more pertinent.

Much has been written, and with some show of truth, against the use of braces in rachitic spines, and constant recumbency advised. While this latter measure is easily enough carried out in very young children, it is not so in older ones, and it is certainly better to have a child enjoy the sunlight and fresh air and exercise, with a light, well-fitting support, than to add to its already imperfect general condition the confinement necessary to one position. I confess that the indiscriminate use of apparatus, such, for instance, as are applied directly by and through the advice of instrument-makers, is to be deprecated, and the patient should only wear such supports as are constructed by the advice and under the immediate supervision of the educated orthopædic surgeon. Any apparatus having the antero-posterior leverage principle will afford efficient support. It is alone necessary that they should be light, easily adjusted, and capable of modification by the surgeon. I have personally used, with great satisfaction, a modification of the Taylor spinal brace, without the hinged pad-plate. I believe, however, the choice of apparatus, and the success attained, depend largely on the surgeon's familiarity with it.

In conclusion, I thank you for listening so patiently to these very prosaic remarks, but hope some of the points advanced will be of service to those whose experience is not so extensive as your own.

DISCUSSION.

Dr. E. H. Bradford, of Boston.—I shall have very little to say in regard to Dr. Ketch's paper. He mentions very clearly the diagnostic points. I simply would like to state that I have made an error in diagnosis, considering a case of caries of the spine in the early stage rachitic. It is a mistake which I should not have made if I had exercised ordinary care. If we were to examine our cases carefully, such mistakes would not occur; but sometimes it is difficult to differentiate.

In regard to the treatment, I do not think there is anything to be added to Dr. Ketch's excellent rules. You can keep on the apparatus you think best in young children, and in older patients a light form of support is the best thing you can use.

Dr. A. J. Steele, of St. Louis.—I would like to ask Dr. Bradford if the posterior portions are involved, as well as the anterior.

Dr. Bradford.—I am not a sufficiently good pathologist to determine that, but I am under the impression, however, that they are not.

Dr. Arthur J. Gillette, of St. Paul, Minn.—I would like to ask Dr. Ketch if he did not advocate the use of a brace.

Dr. F. H. Milliken, of Philadelphia.—I should like to ask Dr. Ketch whether, in his experience, he has found the localized pain of rachitic curvature approximating the pain that is found in spinal caries.

I had a case in which I was in great doubt. There was a pronounced lumbar curve. The child complained of pain in this region when pressure was made on the shoulders or on the head. In addition to this deformity, however, the child had beaded ribs, large joints, and anterior bowing of the tibiæ. In this case I did not apply a jacket, but kept the child in bed for three weeks. At the end of that time the tenderness had entirely disappeared.

Dr. Samuel Ketch, of New York.—Regarding the pathological point which has been raised, I will state that it has been found, as a

rule, that softening of the bone takes place rather on the upper and ower surfaces of the vertebræ, in preference to either the anterior or posterior surfaces. There is no rule about it. It may involve any portion of the vertebræ. It may attack the anterior, posterior, superior, or inferior parts.

Dr. Gillette asked me about the use of braces. I stated that I rarely used them in very young children. In older children I use a brace, after the acute stage is passed, and where I have the deformity to deal with rather than the acute disease.

Regarding localized pain, I think the fact the doctor has mentioned of localized pain over the vertebræ was in favor of rachitis rather than caries. As a rule, the pain in dorso-lumbar Pott's disease is uniformly anterior. Of course, there are exceptions. My experience has been that in true caries of the spine we rarely have a localized pain, demonstrated by pressure on the vertebræ.

Dr. Milliken.—I do not think that I made myself clear when I spoke of localized pain. I did not mean that direct pressure was painful, but that downward pressure on the shoulders would give rise to pain in the deformity of rickets.

Dr. Ketch.—In the first place, I stated that many of the cases were amenable to treatment, and that success is attained by any apparatus with which the surgeon is most familiar. I expressed an opinion in regard to apparatus frequently used by me. Most of the pressure or superincumbent weight comes on the dorso-lumbar spine. In a child of that age the physiological curves are not as yet formed, and when the child sits up the spine is like a bow, and the weight comes on the lower portion of the spine.

THE RELIEF OF PARAPLEGIA.

By A. J. STEELE, M.D.,
ST. LOUIS.

Among the most pitiable cases that are brought to our notice, as specialists, are those helpless children deprived of the use of their inferior extremities, incapable of locomotion, except as by the strength of the arms the body is slowly and with great effort dragged along over an even surface—cases that are doomed to the charitable assistance of others, and to the aid of the wheeled chair. Six cases of this kind have fallen under my care—all boys—two resulting from Pott's disease, and the others from acute anterior poliomyelitis. One of the two former cases largely recovered by the use of faradism and massage; the other was still rebellious at last accounts. It is, however, to the cases of infantile spinal paralysis, where both lower limbs, including, it may be, the hip muscles are involved, that I wish to call attention.

Too often these cases are brought to us for relief after they have existed some time, and with accompanying contractions and deformities. The latter must first be corrected by tenotomy and stretching. An extended foot will require section of the tendo Achillis; a contracted knee, of the hamstrings; a flexed thigh, of the tensor vaginæ femoris, of the sartorius, and, possibly, by open wound of all the resistant tissues in front of the joint. The flexions being largely overcome, an external apparatus must be applied as a substitute for the absent muscles. The bony framework is present, but direct attachment cannot be made to it; so in an apparatus surrounding the limbs and trunk we find the means to give firmness to the joints. The more accurately and fully these external appliances are made to fit, the more efficient will the mechanical aids become. I have found firm leather casings, shaped over plaster casts of the

parts, to be the most serviceable. It is essential that not only the limbs be thus encased, but that the trunk also be fitted with a leather corset, this to pass well down at the back to find support and make pressure on the sacral and gluteal regions. This, with the thigh- and leg-pieces, all laced in front, and with the shoes, affords an external framework to which lateral steel bars are riveted, with joints at the hips, knees, and ankles. I prefer double side-bars, both at the thighs and legs. A drop-lock may be attached to the hip-joint, in addition to a strong elastic webbing passing at the back of the joint, from the jacket above to an arm on the thigh-piece below. Both a stop and ring lock-joint at the knee, and a stop-joint at the ankle, to prevent extension or dropping of the foot, are necessary. Thus equipped, the patient can stand, and with the aid of crutches auto-locomotion becomes possible, either by one foot thrown forward at a time—a hitch, or both feet together—a swing.

It is remarkable, after a little practice, how actively these patients get about—transformed from helplessness to self-dependency.

Where there is flexion of the thighs, I have placed padded metal plates over the upper gluteal regions, attached to a steel arch springing from the lateral bars of the body brace. As this body brace or jacket passes so high anteriorly it becomes a lever, efficient in the straightening of the flexed hip.

Three of these extreme cases of paraplegia are now wearing the apparatus outlined above, and though portable appliances with crutches may be a lifelong appanage, yet how preferable this, with self-reliant ability to get about, than dependence on an attendant or on a wheeled chair.

If cases are seen sufficiently early, then massage, faradism, and dry heat all find place in keeping the muscles from further destructive change. In the employment of therapeutic means to limit the destructive inflammatory action in the early stage, care should be taken not to push strychnine or galvanism too far. I have a case in which strychnine was administered too soon after the febrile attack, and before the signs of irritative action had entirely disappeared from the cord, with the result of increase in the arterial activity and exaggeration of the morbid symptoms; and, too, I believe, the interrupted galvanic current was too energetically employed.

DISCUSSION.

Dr. Samuel Ketch, of New York.—I had presumed, from the title of Dr. Steele's paper, that it was simply in relation to the term paraplegia, as orthopedic surgeons use it, principally in connection with Pott's disease of the spine, but probably there is also included in that relief from infantile paralysis. With regard to the latter I have nothing to say; but it seems to me in speaking of relief from pressure-paralysis we have the result of a bone disease, the breaking down of bone-tissue and pressure against the spinal cord, that the question of application of apparatus for the relief of that is worthy of consideration. Personally, I do not believe in the direct apparatus for the paraplegia of Pott's disease. I think that the indications are those of complete rest. When I speak of not using apparatus for the relief of the paraplegia, I do not include in that mechanical support for the diseased part—the bony lesion. I am speaking of the effects of the disease, such as we see them in the lower or upper extremity as the case may be. I do not believe any form of apparatus can do much good at this time; it is more apt to be a source of discomfort. I am speaking of apparatus such as tends toward locomotion. I think it is a mistake to do anything in the way of locomotion. Our treatment should be absolute and complete rest.

We have paraplegia as a result of two things, either of pressure or as a direct inflammation by continuity from disease of the vertebræ, and all means, such as massage and electricity, would only tend to keep up irritation. Therefore, I think we should endeavor to secure as absolute rest as possible, which does not invalidate the patient's being carried into the open air. I should protest against any apparatus in the paraplegia of Pott's disease that tends toward locomotion.

Dr. Oscar H. Allis, of Philadelphia.—In regard to Dr. Steele's paper, there is one point I would make in regard to restoring the limbs to a line with the body so that locomotion would be possible to fall on the two limbs as one. I have taken cases like those mentioned by the speaker in which the hip, knee, and ankle were so distorted as to require special attention for each. When in such cases

I have attempted to rectify all the joints at once I have signally failed. But when I would begin at the knee, for instance, and first make restoration here, getting it straight, then after that perhaps taking the ankle, then finally taking the hip, I would succeed well and, what is of great importance, would save time for myself and patient.

Dr. G. G. Davis, of Philadelphia.—If I understand Dr. Steele correctly, his treatment applies to those cases which are chronic and in a hopeless condition; therefore, the remarks Dr. Ketch has made hardly apply.

As regards the treatment that has been in vogue in the East—I do not exactly know what is the practice elsewhere, but so far as my observation goes in this city—it is very much according to what Dr. Steele has done. The object is to render the limbs and the body one so that they move together, and this is accomplished usually by some kind of jacket, a steel frame, corset, etc., and to the sides of it are fastened vertical pieces, as Dr. Steele has represented. In the cases in which it is desirable to fix the hip-joint, it is done by extending the upper piece down two or three inches beyond the joint and fastening with a screw which can be removed if motion is desired. Instead of using the arrangement which the doctor has employed, a catch is used which by being pressed on is relieved and motion allowed. The catch extends from above and enters a notch below the joint, so that by pressing on its upper part the catch is relieved and motion at the joint is allowed. The method of fixing the brace by a leather jacket is certainly, I think, more secure than the corset which is usually used. Now, in cases of infantile paralysis such an apparatus is absolutely necessary if they are to get along at all, and inasmuch as in some of these cases there are some muscles which have escaped paralysis, I would like to bring to the notice of the Association an arrangement which I have seen, which might be utilized to advantage, especially in those cases where one limb has some slight muscular action remaining in it. The object of the appliance is to throw the thigh forward. It is constructed of two side irons on either side of the leg and jointed at the knee and ankle; below they are fastened to a steel sole-plate. A short rod extends forward from the thigh pieces a few inches above the knee. The

artificial tendon is attached above to these projecting rods and below to the extremity of the heel. When the weight of the body is put on the toes the heel descends, and thus tends, by means of the artificial tendon, to pull the thigh forward. This might also be useful in some cases in conjunction with an elastic arrangement at the back. This mechanism was suggested by Mr. Osborne, of this city, and may be used in cases of infantile paralysis. It has not appeared in any of the books, and I thought it was worth while to bring it to your notice.

Dr. John Ridlon, of New York.—I believe the apparatus of Dr. Steele is an excellent one for cases of anterior poliomyelitis. But I wish to support the position taken by Dr. Ketch, and shall object to anything of this kind being used in any case of Pott's paraplegia. I cannot conceive of such a thing as a hopeless case of Pott's paraplegia. Every case of Pott's paraplegia is benefited by, and should receive treatment by, perfect rest; and no case of Pott's paraplegia is hopeless.

Dr. A. J. Steele, of St. Louis.—Supposing it is hopeless, a change has taken place in the cord, the inflammation and irritation have subsided, and there is the patient. May not such an apparatus be used?

Dr. Ridlon.—Not in the acute stage; and not so long as any evidence of disease in bone or cord remains.

Dr. Steele.—It seems to me that something of the sort might be used to advantage. In one case the child was taking no means to better its condition, and the muscles were becoming fatty-degenerated rapidly and soon lost all the muscular tissue. In such a case it might be used to advantage.

In these four cases of paraplegia from infantile paralysis, the disease had passed away and left the condition I have spoken of. Boys are active, and the manner in which they get about with this apparatus is sometimes astonishing to me. It is necessary in such cases that the apparatus be well made, otherwise breakage will be frequent.

THE PROGNOSIS OF PRESSURE-PARALYSIS.

By T. HALSTED MYERS, M.D.,
NEW YORK.

At the present time, when surgeons are so eager to operate upon the spinal cord to relieve pressure-paralysis, it is important, if possible, to establish the prognosis of cases left without operation.

I have limited myself to a consideration of the pressure-paralysis of Pott's disease, and the cases studied are all those which presented themselves at the New York Orthopedic Dispensary up to the beginning of the present year, which have been kindly placed at my disposal by Dr. Shaffer. A number far too large to tabulate, hence my statements must be general ones.

Of these 1570 cases, 218 were sooner or later paralyzed; 16 from disease of the cervical vertebræ, 12 cervico-dorsal, 105 from dorsal disease above the eighth, 40 from lower dorsal, 19 dorso-lumbar, 18 lumbar, and 9 unspecified.

The average duration of the paraplegia of these cases, in which it was noted, and which were known to have recovered, as estimated from the onset of the symptoms until the patient walked well, was in the cervical region 12 months, in the upper dorsal 9½ months, in the lower dorsal 6 months, and in the lumbar 8 months. The longest duration in the cervical region was 24, in the upper dorsal 48, in the lower dorsal 12, and in the lumbar 24 months. I wish here to mention another case of cervico-dorsal disease, though its termination is not known, which was beginning to improve after a paralysis of five years' duration; the paralysis of the sphincters having disappeared, and the child walking, though with ataxic gait.

It is interesting to note that of these 218 cases, 85 became paralyzed while under treatment (5 of these were in the cervical region, 53 in the upper dorsal, 21 in the lower dorsal, and 6 in the

lumbar); and that in these the average duration, calculated in the same way, was less than that already noted, viz.: in the cervical region but 5 months, as against 12 months; in the upper dorsal but 7, as against $9\frac{1}{2}$; in the lower dorsal 5, as against 6; and in the lumbar but 3, as against 8 months.

Eighteen of these 218 cases had repeated attacks of paralysis, usually the result of injury, acute disease, or lack of the proper attention to the braces. These subsequent attacks were of neither greater nor less duration, nor did they vary in severity, as a rule, from the original attacks, and they were recovered from equally well. Two cases had 4 attacks, and a number had 3 with good recovery. All cases, however, were not so fortunate, and I found 2 recorded where the patient had passed through 1 and 2 attacks, and finally died paraplegic.

The interval between the attacks varied from a few months to $4\frac{1}{2}$ years.

A late onset of paraplegia sometimes occurs. In one of these cases it first appeared $7\frac{3}{4}$ years after the onset of the disease. The average duration of the disease, however, before the onset of paralysis, I found to be in the cervical region, also in the upper dorsal, 13 months, in the lower dorsal 15, and in the lumbar 18 months.

I found no cases where the bony lesion was below the motor area involved. Paralysis affecting the upper extremities was recorded in only 7 cases. Of these, 3 were not treated at all, 1 died after an operation on a cervical abscess, and 3 were cured.

Some cases recover without treatment; these records show 13 such.

That the character of the kyphosis does not affect the paraplegia is very well shown in two of these cases, where the improvement in the paralysis was coincident with well-marked increase in the kyphosis.

The first indication of paraplegia is the exaggerated knee-jerk. This occurs sometimes a considerable time before the loss of motor power, and persists also after recovery from the latter. Weakness is the next symptom; the patient complains of getting tired easily. In most cases this is accompanied, as we should expect from the pathology, by pain or paræsthesia, but it was surprising to me that many cases became bedridden without complaint of any accompany-

ing pain. The motor paralysis usually attacks both lower extremities at once. In some cases, however, one limb is affected before the other, or more severely; in still rarer cases but one extremity is attacked, or the paralysis affects the upper extremities as well.

Ankle clonus is noted much less frequently than increased knee-jerk. Usually this symptom disappears much earlier also. The superficial reflexes, unless well marked, are, I think, in children, unreliable. Spastic rigidity of the limbs and anæsthesia are later symptoms, indicating a very considerable degree of pressure. The muscular twitching movements which are sometimes observed early are due to irritation of an abnormally sensitive reflex arc, which may be theoretically either central or peripheral. This exaggeration of the reflex action makes it difficult to determine, in some cases, whether there is anæsthesia or not, as the muscular movement resulting from a pin-prick seems closely to resemble a voluntary act. A child may, besides, be cognizant of the grosser movements of the limbs, though insensitive to painful impressions.

Paralysis of the bladder, almost exclusively in the form of incontinence, is noted in these cases much more frequently than rectal paralysis. I have seen the statement that cases in which the bladder was paralyzed for three months would probably never recover. In my cases which recovered, several were paralyzed for two months, and two between three and four months.

The first evidence of improvement is cessation of pain (where it exists), then diminution of the clonus, with a gradual return of power to the affected limbs. The exaggeration of the knee-jerk often persists months after the patient is able to walk well. In one case it was present nine months after. In cases of repeated attacks of motor paralysis it sometimes almost bridges the interval between the attacks, though this is by no means universally so, and I hesitate to say more than that it is taking a risk to let a case with exaggerated knee-jerk walk. A patient with ankle-clonus should never walk. The presence or absence of abscess seems to make no difference in the prognosis of the paralysis. A sudden onset, or sudden relief from pressure-symptoms, not associated with traumatism, I think is due, in some cases, to rupture of an abscess into or from the spinal canal. I have seen two beautiful specimens of the former accident.

The prognosis of paralysis depends upon the extent of the cord

lesion, which, we have found, is independent of the extent or character of the kyphosis, the rapidity of the onset, and the duration of the disease, but is dependent somewhat on the location. I know of no perfectly certain indication of the extent of the cord lesion. It is most accurately determined by the atrophic condition of the muscles whose nutrition is controlled by the affected region of the cord, by the electrical reactions of these muscles and their nerves, and by the condition of the reflex arc at this point.

The duration of the sensory symptoms, as of the motor symptoms, even the paralysis of the rectum or bladder, is simply confirmatory.

The prognosis is, in general, very good. Of the 218 cases, though 55 per cent. only are *known* to have recovered, 26 per cent. (none included in the recoveries) were not treated at all, and at once passed from observation; 3 per cent died of intercurrent disease, and the termination of the remaining 16 per cent. is unknown.

DISCUSSION.

Dr. James K. Young, of Philadelphia.—In this connection, I should like to call the attention of the Association to two cases published by me in the *University Medical Magazine*, in which there was loss of sensation as well as motion. These cases have usually been considered beyond hope. The result in these two particular cases proves the very opposite to be true. Both of them recovered, and are now actively engaged in their respective occupations. In both cases there was complete loss of sensation in both limbs. Under rest and appropriate treatment the sensation returned and motion followed, complete recovery resulting.

Dr. Arthur J. Gillette, of St. Paul, Minn.—I would like to ask a question in reference to the treatment in these cases of paraplegia. I attended a meeting not long ago where a prominent physician reported a number of cases in which he obtained great benefit by the administration of large doses of iodide of potash, the mechanical treatment being kept up in three cases. I would like to know

if that is ever used by any of the members present and whether any benefit is derived from it.

Dr. F. H. Milliken, of Philadelphia.—I have had under my care for the past few months a colored boy of about thirteen years of age who suffers from pressure-paralysis due to kyphosis of the upper dorsal region. As a result of the kyphosis the boy had well-marked spastic paralysis. The legs were held in close contact and were so rigid that they could not be separated, even under ether. Sensation was blunted—the calipers were separated ten inches before pressure-points could be recognized. The boy had no control over his bladder or bowels. With a view to relieving the pressure on the cord, the boy was placed in bed, and extension and counter-extension were employed. He was kept in this position for three months. He was then, in addition to extension in bed, made to suspend himself by means of Sayre's spinal swing for fifteen minutes twice a day. There was no improvement apparent from this treatment, and my patient was then allowed to do pretty much as he pleased. About three weeks ago (one month, at least, after abandoning extension) he suddenly took it into his head to walk. I was surprised, at my next visit, to see him staggering across the yard with a gait similar to that which we observe in locomotor ataxia.

Dr. Samuel Ketch, of New York.—We have deviated a little from the question of prognosis toward the question of treatment.

Dr. Myers's paper proves conclusively to me the remarks I made concerning the use of apparatus in paraplegia. We are bound to look upon the paraplegia of Pott's disease, as I said before, as an irritation due either to pressure or the spread of inflammation from the vertebræ to the spinal cord.

I was rather surprised to hear about the destruction of cells in the cord accompanying paraplegia of Pott's disease. I can appreciate the condition in the cord and in old cases of infantile paralysis. I never heard of an autopsy which showed such a condition. The symptoms are those of irritation and pressure and not of cell-destruction. We have all the muscles intact. As regards electrical reactions, they are not degenerative; all we know is that the symptoms denote intense degree of pressure and interference with the functions

of the spinal cord, but never a destruction of the elements of the cord.

Dr. Myers's paper, I think, is not only interesting, but exceedingly valuable as tending to give us a scientific basis upon which to make a prognosis in cases of pressure-paralysis. Those who have seen many cases of pressure-paralysis promise a recovery in the majority of them. Even after repeated attacks of paraplegia we can still, in a vast majority of cases, promise a recovery. I have seen a few such cases as Dr. Myers has outlined where both sensation and motion were involved which were treated for a long time, but ultimately there was restoration of function of the parts. The indications for the relief of pressure-paralysis are such as I find in rest, immobilization, and not in active measures which will tend to increase the irritation of the cord.

Dr. George W. Ryan, of Cincinnati.—I was not able to listen to the paper attentively, and did not quite catch the points the doctor dwelt upon.

I agree with the opinion expressed that in some of the cases there is degeneration and great atrophy. I speak from a clinical standpoint. One of my cases lasted for a period of five years. I have seen a few cases where there had been some cell-destruction about the anterior horns of the cord. In these cases I should not feel encouraged to give a favorable prognosis; in fact, I would give a very unfavorable one. In a large proportion of cases we can say to the mother and father that the result will be favorable. I have known cases where there had been two or more attacks of paraplegia; but there are only a few cases in which there is cell-destruction, and I am satisfied I have seen it.

Dr. John Ridlon, of New York.—I presented a piece of spinal cord to the New York Pathological Society some years ago, and the committee on microscopy reported that the cell-elements for more than an inch were completely destroyed; nevertheless this case completely recovered from the paraplegia. This case rested on her back for over three years in St. Luke's Hospital, and then recovered locomotion perfectly. This bears out the position taken, that the prognosis is good, if we only let the cases alone. The only cases

that have not recovered, in my experience, have been those which were put into the hands of the Swedish-movement men.

As for the hopeless cases that have been referred to, I have never seen or heard of any such.

Dr. A. J. Steele, of St. Louis.—I have told my patients there was no danger of permanent paralysis in Pott's disease. I have never had but one case that did not recover. I gave large doses of iodide of potash, with the extension which has been spoken of, and yet that little patient is lying to-day perfectly helpless.

Dr. Ketch speaks of irritation; I presume he means by that inflammation. Suppose that inflammation is active and has lasted for a long time, may we not have cell-change? It seems to me so. For instance, there is pressure upon the cord, which, perhaps, may rarely occur; it astonishes us that the lumen of the vertebral canal remains so large that the cord is not pressed upon. Suppose it is pressed upon, either by the bone or by the thickening, would we not have cell-change in the cord?

Our President suggested operative measures, and I presume he means by that taking out the laminæ and thereby removing the pressure on the cord. We saw a case yesterday at the hospital where this had been done, but without improvement as yet. If you have cases of Pott's paraplegia, I think such an apparatus as I suggested will prove of service.

Dr. Ryan.—In a case of paraplegia that lasted eight years—would you consider that hopeless?

Dr. Ketch.—I would still give the parents ground for hope.

Dr. L. A. Weigel, of Rochester, N. Y.—While many cases of paralysis recover in due time, it must be borne in mind that we cannot always give a favorable prognosis. I recall at least one case in which paralysis had existed for seven years or more in a man thirty-eight years of age. He was in bed the greater part of the time he was under treatment. All recognized remedies were used, but there was not the slightest improvement in his paralysis. There was a progressive increase; he developed bed-sores, and finally died.

Dr. Benjamin Lee, of Philadelphia.—I have listened with much interest to this paper, which is a valuable one, as all papers must be which are based on a careful analysis of a large number of cases.

With regard to this term pressure-paralysis, which has come into use of late years, I confess I never was able quite to satisfy myself as to its thorough applicability in the paralysis accompanying spinal caries. What causes the pressure? We know that we may have a curvature of the most extreme form without paralysis. On the other hand, you may have a curvature of the slightest degree, and paralysis shall be present. I have one in mind now, where only an experienced touch will discover the curvature, and yet the paraplegia is complete. What causes the pressure? It certainly cannot be the distortion. Is it an effusion into the spinal canal? That is possible. I am inclined myself, where I find ankle-clonus, to believe there is meningeal inflammation extending by contiguity from the vertebral bodies to the meninges, and I have felt less inclined to give a favorable prognosis in these cases than in those where the ankle-clonus was absent. I have constantly seen recovery in cases of complete paralysis both of motion and sensation, but, in my experience, where we have spastic contraction and ankle-clonus the prognosis is not so favorable. The cases are much more tedious, even when they do recover. I certainly have seen cases of paraplegia accompanying Pott's disease in which there was no improvement. It would have added to the value of the paper, to me personally, if the writer had stated what the symptoms of pressure-paralysis are, whereby we may distinguish it from meningeal paralysis and the paralysis of inflammation of the cord. I confess that line of demarcation, in my mind, is a very difficult one.

Dr. Myers.—I have used the term paraplegia to signify a bilateral paralysis of motion of whatever extent.

I have never used iodide of potash in a sufficient number of cases to tell its value definitely.

Many of the cases which I have reported had sensory symptoms, sensory paralysis, and some of them for a considerable length of time; but I called attention to the fact that children are often hard subjects to examine in this respect, slight causes exciting a reflex action simulating one which is voluntary.

The sudden recovery mentioned by Dr. Milliken, I think, might be explained on the hypothesis that the pressure was caused by an abscess in the spinal canal, which ruptured, and so the pressure was relieved. I know that sudden onsets are caused in this way. I have myself seen two very beautiful specimens of it, where large abscesses between the vertebræ had pushed back and had ruptured through the posterior common ligament, thus causing paralysis at once.

I feel that, in certain cases, there is destruction or sclerosis of the cord, such as Dr. Ridlon has referred to. Bramwell figures in his book a very beautiful specimen of that. I do not think there are grounds for belief that if a cell, or nerve, or muscle, is once entirely degenerated it will ever recover. I think very often, in these cases, that some cells are completely degenerated and others are only temporarily affected to a less degree, and that the latter recover. I do not understand how a cord can be totally destroyed, and yet afterward recover its function. I think, in reports of such cases, there must have been a mistake in the pathological examination, some fibres not being affected.

In regard to the treatment, I would like to say that in very many of these cases there were preliminary symptoms, then the brace was applied, and in a few weeks the symptoms disappeared. There was only a slight loss of motion for a week or two. The longest case I have recorded, which Dr. Ketch spoke of as being of eight years' duration, was in the upper dorsal region, lasted four years, and recovered.

Dr. Lee spoke of the difference between pressure-paralysis and the paralysis of meningeal inflammation. I consider them one. I do not think the spine itself has anything to do with the symptoms of pressure. As I stated, there were two cases where the pressure-symptoms improved, while the deformity increased. I think the inflammation is a pachymeningitis, and that the symptoms indicate irritation, and afterward destruction.

THE ADVERSE LEVER AT THE ANKLE-JOINT.

By A. B. JUDSON, M.D.,
NEW YORK.

Since the last meeting of the Association my attention has been called to the mechanism of the ankle-joint, and I have been led especially to observe and describe the lever which operates to the disadvantage of the muscles of the calf when they produce extension of the foot on the leg.

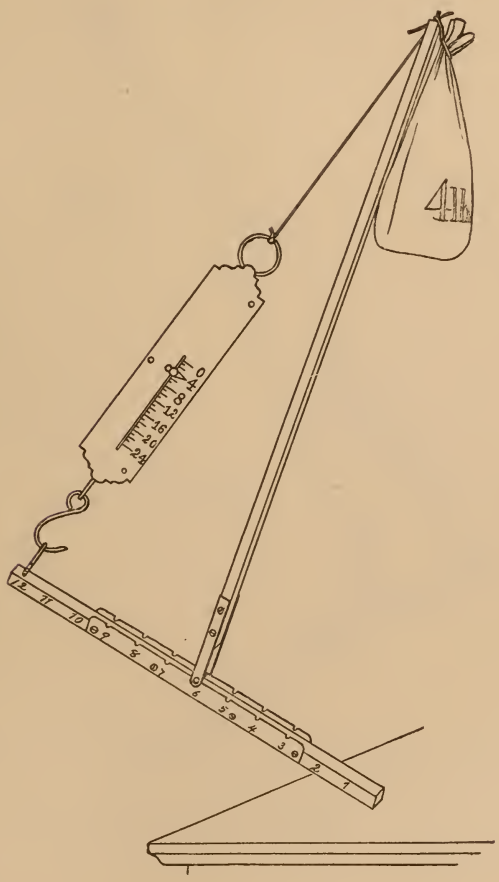
This observation is well illustrated by the apparatus which is shown in the cuts. In this machine the muscles are represented by a spring balance, and wooden sticks take the place of the foot and leg. The weight of the body is represented by a four-pound bag of shot. The machine can be kept balanced for an indefinite time by a light touch of the hand, and the joint representing the ankle is movable between the heel and toe.

On trial, it is found that when the ankle is near the toe the balance registers a small fraction of a pound, and when the ankle is near the heel it registers twenty or twenty-four pounds, the limit of the scale. In Fig. 1 the ankle is midway between the heel and toe, and the four pounds of shot are represented by four pounds on the balance, showing that if the ankle were midway between the two extremities of the foot the strain on the tendo-Achillis would be equal to the weight of the body. In Fig. 2 the machine is adjusted in closer imitation of Nature, and the ankle is three inches from the heel and nine inches from the toe. It is now seen that the four pounds of shot produce a strain which is registered by the balance as twelve pounds.

It is thus demonstrated that the adverse lever at the ankle-joint greatly increases the work of the muscles of the calf and the tension

of the tendo-Achillis. To estimate this strain, the weight of the body is to be multiplied by the number of times the distance from the heel to the ankle goes in the distance from the ankle to the toe. The foot may also be considered as a lever of the second order, as

Fig. 1.

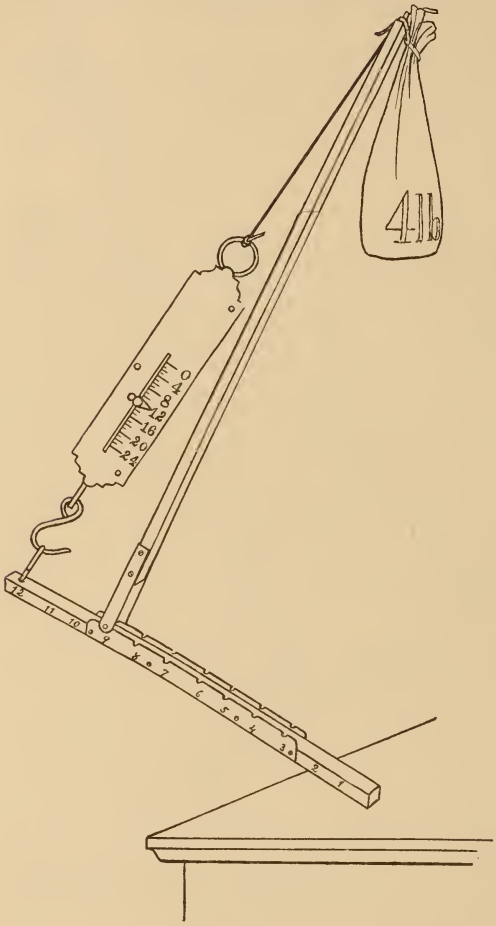


was taught by Mr. John Marshall, from whose work on *Physiology* Fig. 3[1] is copied, in which the weight is between the power and the

[1] Outlines of Physiology, American edition, 1868, p. 136, Fig. 49. Cut used by permission of the publisher.

fulcrum. These elements are reproduced in Fig. 4, where the forces in equilibrium about the fulcrum C are the upward tension of the heel-cord at A, represented by T, and the downward pressure of the

Fig. 2.



tibia at B, represented by R. The moments being equal, T $\times$ A C $=$ R $\times$ B C. As R is the resultant of the tension of the heel-cord and the resistance of the ground at C, which is equal to the weight

of the body, represented by W, $R = T + W$. Therefore, $T \times A\,C = (T + W)\,B\,C = T \times B\,C + W \times B\,C$. Or, $T \times A\,C - T \times B\,C = W \times B\,C$. But $A\,C - B\,C = A\,B$. Therefore, $T \times A\,B = W \times B\,C$, or $T = \frac{W \times B\,C}{A\,B}$. If, now, $W = 4$ pounds, $B\,C = 9$ inches, and $A\,B = 3$ inches, then $T = \frac{4 \text{ pounds} \times 9}{3} = \frac{36 \text{ pounds}}{3} = 12$ pounds.

Fig. 4.

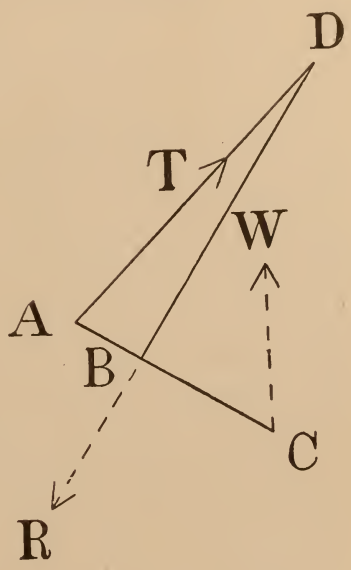
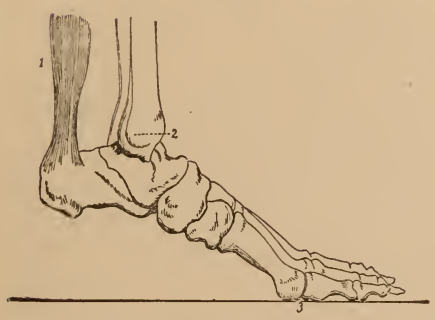


Fig. 3.



This observation leads to a better appreciation of the difficulty of relieving paralytic talipes calcaneus. It follows that the artificial shortening of the tendo-Achillis will be followed by secondary elongation of the tendon above or below the scar of operation. It it also evident that an instrument designed to hold the foot at a right angle with the leg, so that the weight of the body can be thrown on the toe, must be constructed with due regard of the great strain it will have to bear.

REASONS WHY SOME ATTEMPTS TO APPLY TRACTION DO NOT SUCCEED.

By HENRY G. DAVIS, M.D.,
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Through the kindness of Dr. Ridlon, of New York, I received his papers upon Hip-disease and his treatment.

As his experience in a few cases differs materially from mine, I am induced to give my mode of treating the disease in detail. It will be remembered that the treatment of diseased joints by *continued traction* from the beginning to the end of treatment, or, I might say, until a cure is effected, was introduced by me some fifty years since. As it was altogether new, it has been with me, from the beginning, a constant study.

Dr. Ridlon states that in some cases traction does no good, and in others is positively injurious. This is the reverse of my experience. I have never found a case in which traction, *properly applied*, did not relieve the pain and render the patient perfectly comfortable. Now, as my experience runs through a longer time, and probably a larger number of patients, I think it safe to conclude that these different results must be owing to the different modes of applying the traction.

In the first place, I never make extension by means of a splint at first. Again, he states that the limb was flexed "about twenty degrees," "motion limited in all directions by involuntary muscular spasms." Now, if a diagram of the femur flexed at an angle of twenty degrees, and the place of attachment of its flexor muscles, were shown, it would be evident that any attempt to bring the limb into a straight position would increase the pain in proportion as the leverage increases the pressure. This is exactly the result in his case. To mark the difference in the application of traction at first,

I will give my mode of procedure in a case quite as susceptible as the one he relates. On my first visit to a young girl, I found her with her limb drawn up close to her body, and held by her hand to prevent any motion. The joint was so sensitive that she would not allow any one but her mother to come near her bed, and her mother was always cautioned not to jar the bed or disturb her position. I assured her that I should not do anything to give her pain, but, on the contrary, afford her relief. It is as necessary to allay mental anxiety as it is to avoid giving pain by manipulations. If it is not done, the muscles will be constantly on guard, contracting at the slightest provocation. After my preparations were made for applying the adhesive plaster, I very carefully introduced my hand above the knee-joint and began extension, without changing the direction of the limb. After a few moments she looked up at me with a smile, saying that it did not pain her now. In a short time an assistant took hold of her foot and ankle, making extension without disturbing the femur. Soon she began to change her position of her own accord. This was an indication that she felt that she could do it without suffering. I now began to bring the limb into position, and it was soon on a line with the body, so that the adhesive plaster could be applied. The limb was dressed and the weight attached. This freedom from everything unpleasant was due to the care with which the head of the femur was separated from the diseased surface, allowing of its movement without friction. The next day she appeared as happy as though she had never suffered.

I may here give my mode of treatment in all cases of hip-disease.

After the patient can move about on the bed without appearing to guard against pain, I apply my splint with seven or eight pounds of extension; when this is adjusted, I buckle an inelastic band over the other so tight that the weight of even the body will not cause the diseased surfaces to impinge upon each other. It is this constant and unremitting separation of the diseased parts that allows the joint to recover with no greater destruction of parts than exists at the commencement of treatment. This has been the uniform result when patients have remained under my care.

My next move is to put the patient upon crutches so that he can take outdoor exercise. My crutches were supplied with an adjustable handle, which could be so placed that the patient bore his weight

upon his hands instead of under the arm at the top of the crutches. In walking he was instructed to move the affected limb forward as in the usual manner of walking, or simultaneously with the other. This gives passive exercise to the joint without any friction. As motion is a natural exercise for a joint, the arrangement is undoubtedly of great advantage in promoting the restoration of the affected parts; but it must positively be accomplished without friction of the bones of the joint. This must be continued until the patient appears to pay no attention to the limb, and feels no difference between that and the other.

It will be observed that I do not examine the limb by manipulating it, to see if there is any tenderness of the joint, because by so doing pain is produced and the patient may be weeks recovering from the effects of the examination. In a recent report of a case I saw this result fully illustrated. After the patient had been improving for some time an examination was made (I suppose to see if the recovery was perfect). "In the course of the examination the femur was crowded forcibly upward and twisted until the patient flinched and then cried, and muscular spasms prevented further motion. On the following day all motion at the joint was abolished, it being held rigid by involuntary muscular spasm, and attempted manipulation was painful. She was kept in bed, and by June 6th, nearly a month after, was again in the condition noted prior to the examination."

Here the patient was set back a month by, to say the least, inconsiderate interference.

I have seen complaint made that the adhesive plaster irritated the skin, so as to be unendurable. At the commencement of my treatment of joint diseases the only plaster to be procured was that spread upon plain cloth; this could only be applied to a plane surface, and was very inefficient for the purpose of extension in hip-disease. I succeeded in getting some spread upon twilled goods which I could apply to uneven surfaces, and which would hold when extension was made. Using this new plaster, I found that it irritated the skin of some patients; to obviate this, I exposed it to the air and sun until it was so dry and hard as to crack when bent, necessitating warming it before it could be cut with the scissors. To apply it to the limb, I immersed it in hot water, and applied it as hot as the patient could

bear. This heating of the cloth served to keep the plaster pliable much longer than if the surface only were heated. After application the plasters were secured to the limb by a roller-bandage closely applied, and where the parts lapped upon each other they were wet with flour-paste to hold them together. I always apply the plasters the whole length of the limb from the ankle to the hip, having found that they do not answer the purpose when applied only to the thigh.

I have heard great fear of consequences expressed from abscesses about the joint. My practice has been, after extension had been applied for a week or more and the swelling did not diminish, if the abscess was small, to apply an ointment of bichloride of mercury by cutting, in a piece of adhesive plaster, a hole the size of a dime, and placing it on the skin over the swelling, then applying the ointment in the opening of the plaster, and putting another piece of plaster over it to keep it from spreading. If this did not succeed in removing the matter, it might be necessary to open the abscess. This was done by a simple incision with a lancet; then the matter was gently pressed out, and injections of warm water made until no flocculent matter came out. I then injected a French preparation of chlorine, allowing it to remain a few minutes, after which it was permitted to flow out. Then a small tent was introduced into the opening to prevent its closing, and a roller placed over the parts. The walls of the abscess almost invariably united, and only a slight discharge from the bone remained. In one case only had I an unpleasant symptom following the opening—generally an improvement in the patient. In the case alluded to, a prominent surgeon was called in, as the patient was feeble and predisposed to consumption. After the abscess was opened and discharged the surgeon thrust his finger into the opening to examine the bone; the result was that erysipelas of the whole limb followed, endangering the patient's life.

I have thus concisely given my mode of treating joint diseases. As I introduced this method many years since, and have, in a measure, perfected it as a long experience suggested, and as the results by it have been far better than by any other, I cannot refrain from urging its details upon the notice of all those who attempt to treat joint diseases.

To sum up the treatment, it consists in putting extension upon the limb in the most careful and gentle manner by pulley and

weight. After the sensibility is allayed, the splint can be applied, with crutches of the design named above, thus giving the patient outdoor exercise, while at the same time the extension is maintained. *Under no circumstances* should the diseased surfaces be allowed to come in contact.

Most of these points are more fully explained in my work, *Conservative Surgery*, published by the Appletons, of New York.

DO ORTHOPEDIC SURGEONS OPERATE AS FREQUENTLY AS THEY SHOULD?

By JAMES E. MOORE, M.D.,
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While I believe, with Dr. Bradford, that "our specialty must essentially remain conservative in the best sense of the word," I am sure that orthopedy has not kept pace with other branches of surgery in the past, because its representatives have had a wrong idea of conservatism. It has been believed and taught that conservatism consisted in refraining from operative procedures, and in depending almost entirely upon apparatus. Why should the orthopedist refrain from operating until driven to it by dire necessity, and then call in a surgeon? If oculists had pursued the same course, they certainly would not rank first among specialists, as they do to-day. What would we think of an oculist who would systematically delay operative procedures until the last minute, and would then call upon a surgeon to do his work for him? We certainly would not consider him conservative. The principal reason that orthopedy is making such rapid strides to-day is that we have more orthopedic surgeons and fewer orthopedists. I deem it unsafe to depend entirely upon orthopedists, because they are too prone to delay operation until the best time for it has passed. Many, many times have I, in my experience as a general surgeon, seen life and limb sacrificed in the name of conservatism, when in reality the loss was due either to ignorance or timidity.

It is really remarkable, in looking over the history of orthopedy, to find how few operations have been introduced by orthopedists. This, too, in face of the fact that no one thing has done more to advance orthopedic surgery than the one simple operation of tenotomy. In fact, Stromeyer may almost be said to have been

the father of orthopedic surgery and to have lifted us above "mere buckles and straps." While we are doing better to-day in this matter than ever before, we are not up to the mark yet.

The many valuable operations that have been introduced within the past few years for the relief of disease and deformity, and that are now practised so successfully by orthopedic surgeons, have not been introduced and made popular by orthopedists, but rather in spite of them, and by general surgeons.

No one has more respect for mechanical appliances and their proper use than I have, but I do most earnestly protest against their abuse in the name of conservatism. It is not conservatism to allow a disease or a deformity to go on for months and years under mechanical treatment, when an operation will bring about a cure in a few weeks with perfect safety. I maintain that operating is a legitimate and a necessary part of orthopedic surgery. What right has a man to style himself a surgeon who never performs an operation?

It is the duty of the orthopedist to perform these necessary operations, because general surgeons are too prone to go to the other extreme and operate too much. The general surgeon operates too often, in these cases, because he does not know the value of mechanical appliances, and because he is not content to take the time and to enter into the detail necessary to get results.

Some good results have followed laminectomy in otherwise hopeless cases of paralysis of Pott's disease, and it is but reasonable to believe that the time is not far distant when this will be an established operation. Orthopedic surgeons are certainly most competent to select proper cases for this operation, and they should be the ones to perform it. Up to the present time, however, it has been almost exclusively in the hands of general surgeons.

I presume every orthopedist does tenotomies; but I believe that, on the whole, they are not done as frequently as they should be.

There are those who will torture the little patient for months, stretching a tendon, when a tenotome would do the work in a minute. If it could be demonstrated that the slower way were the better, I should advocate it; but it has not been so demonstrated. With antisepsis, we can do a tenotomy anywhere. When, owing to its depth or proximity to important vessels or nerves, a tendon can-

not be safely cut subcutaneously, it should be reached through open wound. Every orthopedist has wished, time and again, that he could tenotomize the tendon of the psoas and iliacus, but as a subcutaneous operation it is neither safe nor practical. I wish to state emphatically, however, that this operation can and should be performed through open wound. It is not an operation to be undertaken lightly, but in competent hands is perfectly safe. About six months ago, I treated a case of flexion of the hip, in which I could not overcome the deformity after having tenotomized every muscle within reach, on account of this tendon, and in which I finally did an osteotomy below the lesser trochanter. I then concluded that section of this tendon through an open wound would be a better operation, and I have since demonstrated to my satisfaction upon the cadaver that it is safe and practical.

I have not had a case since my demonstration in which the operation was indicated, else I should have performed it.

Orthopedic surgeons have very seldom been accused of operating too often, and have never been guilty, except in one instance. There was a time when too many hip-joints were being excised, even by orthopedists. At the present time, however, we know that early and frequent excisions of the hip are not indicated. We also know that in certain selected cases it is the only thing to do.

My belief is that at the present time general surgeons are excising too many knees, but that orthopedic surgeons are excising too few. In properly-selected cases this is a very satisfactory operation. The reason that it is not in better repute among us is that operation is delayed too long. When apparatus has been applied to a knee until great destruction of bony tissue has taken place, or until the patient is suffering from some organic disease, then excision is not a satisfactory or a safe operation.

In the wrist and ankle, orthopedists have achieved some of their greatest successes, by saving useful members that would have been condemned to amputation by the general surgeon. I am sure every orthopedist can recall many instances of the kind in his own experience. There are many cases of this class, however, that are being treated too long mechanically, the result being amputation. In these cases judicious gouging and scraping at the proper time might save a hand or a foot.

Amputation may many times be properly considered an orthopedic measure. While it is the special province of the orthopedist to prevent the necessity for an amputation, he certainly is the one most competent to decide when all hope of saving a useful limb is gone, and it is his duty to advise amputation as soon as this point is reached. There are many cases coming under the care of orthopedists that are braced up by means of elaborate apparatus which the patient will be obliged to wear through life, in which an amputation would put him in a much more comfortable and useful condition. I have a number of times been requested by patients of mature years to amputate a limber, useless member that they might be saved the trouble of carrying it. In such cases, if we cannot by excision make a stiff, useful limb, we should not hesitate to amputate. In badly-deformed limbs that are not paralyzed, it is seldom necessary to amputate, for, as a rule, they can and should be straightened. It may be necessary to shorten the limb very materially, but this is much better than amputation if the shortened limb has strength enough to perform its function.

I can now endorse the recommendation of Dr. Vance at our meeting in 1888—to excise the knee in these cases of hopeless paralysis of the quadriceps extensor. It is far superior to the best apparatus I have ever seen. I am not prepared yet to recommend excision of the ankle for paralysis, because excisions of the ankle in the abstract are not as satisfactory as knee-joint excisions, and because the application of apparatus is more satisfactory.

The advisability, if not the necessity, of tenotomy in the majority of cases of club-foot is so generally conceded that I need scarcely mention it. Just when more radical operations should be resorted to for the relief of this deformity is far from being settled, but I am quite certain that orthopedic surgeons do not operate as frequently as they should. The orthopedist is doubly responsible in these cases, because, by not operating in certain extreme cases, he fails to bring about a cure, and the case falls into the hands of a general surgeon, who operates with satisfaction to himself and his patient, and is led by this experience to go to the other extreme and to operate upon cases that should be treated mechanically. The Phelps operation, in properly-selected cases, is a good one, and should at times be performed by every orthopedist.

Operations upon bone for club-foot are only necessary in a certain small percentage of cases, but in this small class they are absolutely necessary to success, and should be performed by the orthopedic surgeon. I have seen feet uselessly mutilated by general surgeons in a way that made my orthopedic blood boil; but have been forced to admit that, had orthopedists operated more frequently, fewer of these cases would have fallen into the hands of over-zealous operators.

Next to tenotomy in club-foot, osteotomy in certain cases of bow-legs and knock-knees is, perhaps, the best-established operation among orthopedists.

In simple out-curves of the tibia, osteoclasis should be performed in preference to osteotomy, because it has all the advantages of a simple fracture over a compound one, and because many orthopedists will do an osteoclasis who will not do a cutting operation.

After this brief review of the orthopedic field, I am prepared to answer the title of this paper in the negative, and to assert that, as a rule, orthopedic surgeons do not operate as frequently as they should. I am sure that there is a ground between what the orthopedist and the general surgeon is doing, upon which orthopedic surgery will be firmly placed in the near future. In order that we may reach this happy medium, it is necessary that we admit that, in many instances, the knife is one of the greatest of conservative agents, and cultivate its judicious use. It behooves us to take warning from others, and to avoid that evil tendency of our profession to go to extremes. It is the duty of orthopedic surgeons to operate more frequently than they have in the past, for, by so doing, they can not only do more good for suffering humanity themselves, but can also prevent unnecessary operating by others.

INSTANTANEOUS PHOTOGRAPHS,

LLUSTRATING THE GAIT OF A CHILD FROM WHOM BOTH HIPS HAVE BEEN REMOVED.

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ORTHOPEDIC SURGEON TO THE CHILDREN'S HOSPITAL, AND TO THE SAN FRANCISCO POLYCLINIC.

Emily Keating, at present six and a half years old, was admitted to the Children's Hospital, San Francisco, in August, 1887. She had at that time hip-joint disease, in the second stage of its course, in the right hip. The story of the treatment it is not necessary to recite here; it is enough to say that in March, 1888, her condition was such that exsection of the hip was done to save her life. Her convalescence was quite satisfactory, but in June, three months after the operation on the right hip, the left was found to be in the initial stage of the same disease. The course of the disease in this case was very rapid, and by November it seemed evident that, unless the tuberculous tissue was removed, she would die, and so the second hip was exsected in that month.

From this operation she rallied rapidly and began very soon to put on flesh and to have a better color; and by April, 1889, the wound of the second operation was wholly healed, the wound of the first having healed long before, with the result that each femur was bound to the acetabulum by a short, firm, fibrous band, giving ample strength for the support of the body on either leg.

In a little time she began to move about, and learned first to creep and then to walk, the mechanism of her walk being the subject of the accompanying photographs. Her general health from the time of her recovery from the second operation has remained constantly excellent.

As regards the range of motion at the two hips, the following measurements, taken in August, 1889, are still practically correct:

Right leg, ordinarily held slightly adducted, toes pointing forward:

Flexion at hip, 65 degrees.

Extension, 180 degrees.

Abduction, 15½ degrees.

Rotation through an arc of 10 degrees.

Left leg, also ordinarily held slightly adducted, toes pointing forward:

Flexion at hip, 60 degrees.

Extension, 180 degrees.

Abduction, 26 degrees.

Rotation through an arc of about 10 degrees.

These figures represent the extremes of possible passive motion, and not the limits of the motions the child commonly did or could make. The right leg was half an inch shorter than the left, and this was compensated by her wearing on that foot a shoe with a sole half an inch thicker than that of its mate.

The position in standing (Fig. 1) differs from that of a sound child only in the fact that there is a little lordosis of the lumbar spine, a condition that is quite unnoticeable when the child is dressed.

The ranges of motion permitted at the two hips are ample for ordinary walking on the level, or up and down slight grades; but in her walk she has to contend with three separate disadvantages, owing to the fact that she has no neck on either femur and that the muscles which ordinarily act upon the neck as a lever in moving the limb must now act directly upon the shaft of the bone and in some way drag it into the positions required.

In the first place, the adductors completely overbalance the abductors, for the former can act on the shaft of the bone at some angle, while the latter can only make direct traction in the line of the shaft and tend to shorten the leg rather than abduct it; consequently her legs are ordinarily held with the knees touching, and in the act of walking the knees are not easily made to pass each other without interference.

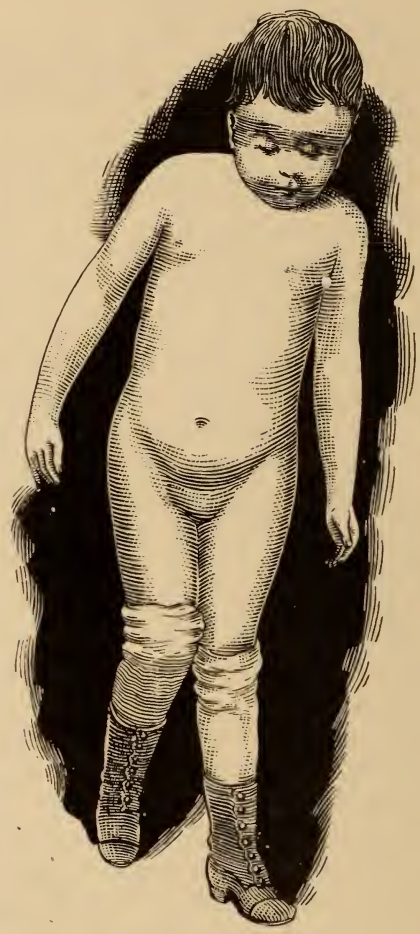
Secondly, the body has to be supported balanced over the upper

end of each femur, and this requires a marked lateral sway to each side alternately as she steps.

Thirdly, the rotation of the trunk forward and backward upon each leg in turn is not possible, and for this rotation is substituted a

Fig. 1.

Fig. 2.



turning of the body and leg together on the ball of the tip-toed foot, the power for such turn being received from the impulse of the previous step. Starting to walk, she will raise herself slightly on the

toes and advance one foot—the right, for instance (the reverse of Fig. 2)—a short distance, at the same time swaying herself from the hips toward the right and slightly forward, and passing the weight of the body from the left to the right foot. As the left foot leaves

Fig. 3.

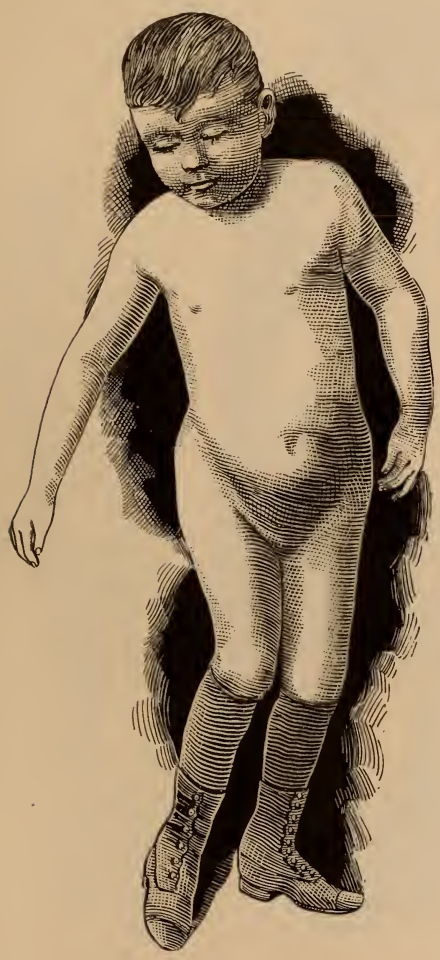
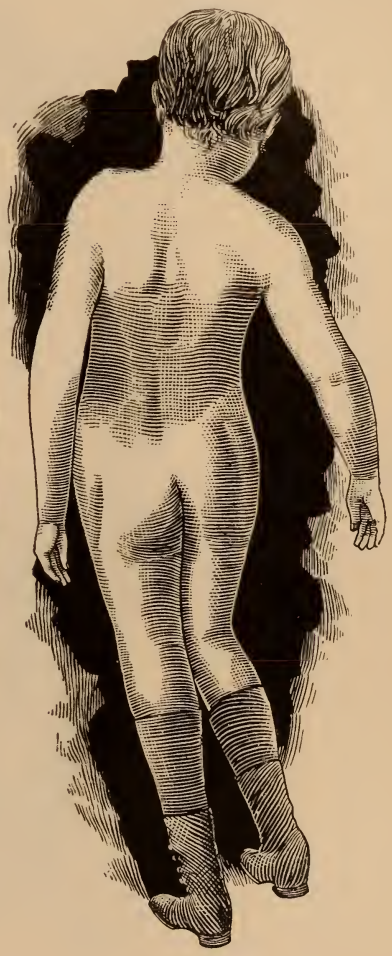


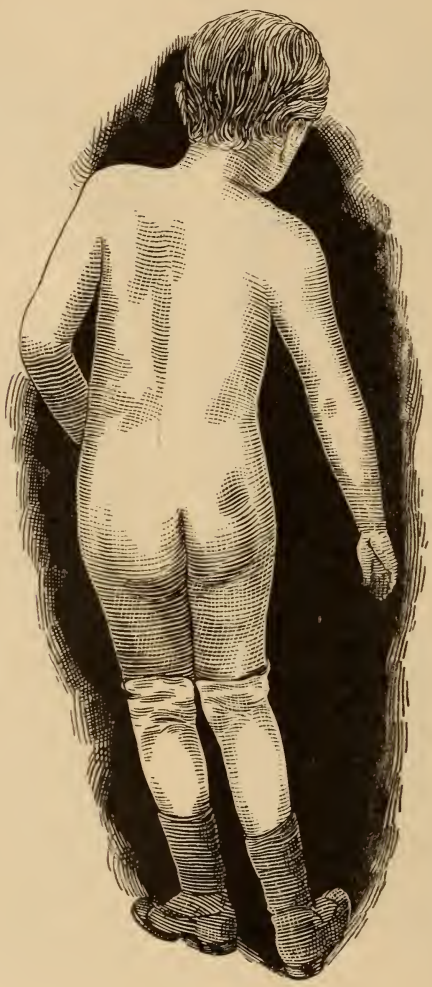
Fig. 4.



the ground it gives a little push (Figs. 3 and 4), the heel of the right is raised, and the trunk and supporting leg turn on the ball of the foot as on a pivot (Fig. 5), the left leg simultaneously advancing

and the trunk straightening up from the forward sway. On the left leg, the lateral sway having changed from right to left with the transference of the weight from the right foot to the left, the same

Fig. 5.



series of acts is performed—the lateral and slightly forward sway, the push, the turn, and the advance of the right leg with the return of the trunk from the sway.

In these acts some slight difficulty is experienced in advancing one knee past the other without touching, but this lessens as the steps are more quickly made, and quite disappears when the child

Fig. 6.

Fig. 7.

runs, and at the same time the stride is lengthened and the whole act is more freely accomplished (Figs. 6 and 7).

Coincident with a step and as an aid in the preservation of her

balance, the arms are slightly raised from the side and swung in the same manner, though not to the same extent, as one walking on a line will swing the arms to keep the balance.

A child with one hip removed will get along very nicely, accomplishing almost all progression with the sound limb, and using the crippled limb as a partial prop, while the sound is very quickly advanced for another step.

It has been most interesting to watch how this child, crippled doubly, felt her way among her muscles, testing their availability, using them when she could, and instinctively devising means of overcoming the obstacle of their inability.

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